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Peer Intervention To Increase Physical Activity Among Working Women

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PEER INTERVENTION TO INCREASE PHYSICAL ACTIVITY
AMONG WORKING WOMEN

by

Sheri A. Rowland

A DISSERTATION

Presented to the Faculty of
the Graduate College in the University of Nebraska Medical Center
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

Nursing Graduate Program

Under the Supervision of Professor Bernice C. Yates
University of Nebraska Medical Center
Omaha, Nebraska

April 2017

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DEDICATION

I dedicate this body of work to my husband, Josh. Thank you for your sacrifice and support on a journey with an unknown destination. It truly would not have been possible without you; this achievement is yours to share. To my children Abigail, Samuel, and Harrison: I hope you learn all that you can about something that interests you; then, use your knowledge to help someone else. To my son, Benjamin: thank you for leading us to healthier living.

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ABSTRACT

Peer Intervention to Increase Physical Activity Among Working Women

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University of Nebraska Medical Center, 2017

Advisor: Bernice C. Yates PhD, RN

Most Americans do not engage in enough healthy physical activity (PA), with working women particularly at-risk for inactivity. Workplace PA interventions have been effective, however studies using peers as the central theoretical strategy, have not been found. Social cognitive theory and social comparison theory were used to develop a peer-modeling workplace PA intervention. The aims of this experimental, two-group, preliminary study were: 1) assess intervention feasibility, 2) determine the intervention effect on cardiorespiratory fitness (primary outcome), and PA behavior, cardiovascular risk, self-efficacy, motivation, and social comparison, and 3) describe participant perceptions of the intervention using qualitative focus-group data. Female employees from a health system were randomized to either an attention control group (ACG) or an intervention group (IG). The ACG ($n = 26$) received general health information. The IG ($n = 26$) participated in six group sessions with a peer-model, received an exercise prescription, and PA information. Measures at baseline and 12-weeks were: PA (ActiGraph), VO_{2max} (cycle ergometer), resting heart rate, glucose, lipids, and cardiovascular risk score. Using hierarchical linear modeling, no significant group by time effects were found. Although PA increased in both groups ($F [df = 1] = 11.4, p = .002$), the IG had greater improvements in measures of fitness and cardiovascular risk compared to the ACG. Both groups decreased in self-efficacy while motivation remained stable. The IG group increased in all measures of social comparison while the ACG dropped in comparisons of ability, opinions, modeling, and future-self. Focus-group data indicated peer-models were perceived to be credible, informative, and motivating. The intervention could be expanded to include more peer-model interaction and nutritional content. These findings support testing the intervention with a fully-powered study.

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CHAPTER 1: INTRODUCTION

Background and Significance

Aerobic cardiorespiratory fitness, an indicator of physical activity (PA) behavior, is one of the most important correlates of general health status and a powerful predictor of cardiovascular disease and all-cause mortality, independent of age, ethnicity, body mass index (BMI), smoking status, hyperlipidemia, and type 2 diabetes (Barry et al., 2014; Kaminsky et al., 2013; Lee, Artero, Sui, & Blair, 2010). Most Americans do not meet current PA guidelines for 150 minutes of moderate-level aerobic activity and two days of strengthening activity per week (“Facts about Physical Activity | Physical Activity | CDC,” n.d.).

Working women appear to be an at-risk group for inactivity with less than 26% meeting the minimal PA recommendations (Blackwell & Clarke, 2016). Life experiences common in adulthood (work, marriage, children) appear to be more of a barrier for healthy PA in women, compared to men (Bellows-Riecken & Rhodes, 2008). The social influences of PA behavior are becoming increasingly evident with social norms, social patterns of behavior, social support, and modeling, all having influence on PA behavior (McNeill, Kreuter, & Subramanian, 2006). Most Americans (82%) spend their work time, at their workplace (“American Time Use Survey Home Page,” n.d.). As such, leading health organizations all advocate for using the workplace to address PA behavior (“American Time Use Survey Home Page,” n.d., “Worksite Physical Activity | Physical Activity | CDC,” n.d.; Fonarow et al., 2015).

Health promotion and disease prevention are scientific priorities. The National Institute of Nursing Research has highlighted the importance of assessing behaviors leading to healthy choices and evidenced-based interventions to promote wellness (“Implementing NINR’s Strategic Plan: Key Themes | National Institute of Nursing Research,” n.d.). The 2010 American Heart Association (AHA) scientific statement on promotion PA in adults provides guidance on intervention development by recommending the incorporation of self-efficacy into interventions

(Artinian et al., 2010). As a cognitive-behavioral strategy, self-efficacy enhancement has been found effective with increasing PA behavior among adults in randomized trials (Artinian et al., 2010). However, these interventions were not delivered in the workplace among “healthy” adults; they were participants with chronic conditions (hypertension, type II diabetes, hyperlipidemia) recruited from clinics, churches, and community centers.

Review of the PA self-efficacy literature indicates there are four effective methods of increasing PA behavior: a) prior success, b) verbal persuasion, c) attention to physiologic cues, and d) vicarious experience or social comparison (observing others successfully perform the behavior) (Ashford, Edmunds, & French, 2010; Conn, Hafdahl, Cooper, Brown, & Lusk, 2009; Williams & French, 2011). Vicarious experience interventions to improve PA behavior have used peers, professionals, or a person unknown to the participant to model PA behaviors (Marcus et al., 1998; Renger, Steinfelt, & Lazarus, 2002). Peers have been found as effective as professionally led interventions in cardiac patients (Andersen et al., 2013). Peers have been used effectively in workplace PA interventions to recruit, motivate, and educate but not specifically to serve as comparison target for a vicarious experience of how to live a physically active lifestyle (Conn et al., 2009; Williams & French, 2011). Although effective, vicarious experience is rarely incorporated into PA behavior interventions (Ashford et al., 2010; Conn et al., 2009; Williams & French, 2011). Workplace PA interventions using vicarious experience have not been found (Rowland & Yates, 2017).

Research Question

Given that working women are: a) an at-risk population for physical inactivity with the associated cardiovascular consequences, b) the workplace is a recommended setting for PA interventions, and c) the use and understanding of vicarious experience as a strategy for behavior change is limited, the following research question was posed: In working women, what is the effect of testing an intervention using active peer-models as a target for social comparison and vicarious

experience of a physically active lifestyle on cardiorespiratory fitness, PA behavior, cardiovascular risk, and self-efficacy for PA?

Purpose and Aims

The purpose of this study was to examine the effect of a peer-modeling workplace intervention among inactive working women. The intervention, based on a novel combination of social cognitive theory and social comparison theory, provided intervention group (IG) participants with vicarious experience for living a physically active lifestyle. The specific aims of the 12-week workplace PA intervention study were to:

1. Assess the feasibility of implementing a peer-modeling workplace PA intervention for the first time by evaluating the number of contacted/recruited participants, number of drop-outs, time for intervention delivery, amount of missing data, and adherence to the intervention.
2. Determine the effect of a peer-modeling PA workplace intervention compared to an attention control group (ACG), among females (19-65 years) employed at a Midwestern health system on the primary outcome of cardiorespiratory fitness, and secondary outcomes of physical activity behavior, lifetime cardiovascular risk, and self-efficacy, motivation, and social comparison for PA.
3. Describe perceptions of a peer-modeling PA workplace intervention using qualitative data obtained from a one-time, focus-group held post-intervention, with a sub-group of IG participants.

Summary

Four chapters are presented to contribute to the understanding of how a novel PA intervention may increase PA behavior in working women. Chapter II explains the state of the science through systematic review of the literature on randomized workplace PA intervention studies. Only intervention studies with PA behavior and/or cardiovascular fitness outcomes were included. Chapter III describes a randomized peer-modeling workplace PA intervention and the

effect on the primary outcome of cardiorespiratory fitness and the secondary outcomes of PA behavior and markers of cardiovascular risk. Chapter IV describes the theories supporting the peer-modeling workplace PA intervention: social cognitive theory and social comparison. The effect of the peer-modeling intervention on measures of these theoretical variables is also detailed. Chapter V reports on the perception of the peer-modeling workplace PA intervention as experienced by a sub-group of IG participants in a focus-group. Finally, chapter VI synthesizes content from all chapters to inform on the research question for this dissertation, and address implications for clinical practice and future research.

CHAPTER II: Manuscript 1

Systematic Review of Randomized Workplace Physical Activity Interventions

Submitted to the Journal of Workplace Health & Safety

Abstract

The workplace is an environment appropriate for health behavior interventions. Personal physical activity (PA) devices, mobile and web-based activity applications have become more available and affordable. Effectiveness of using technology independent of, or in combination with “high-touch” methods in interventions, has not been reported. The objective of this systematic review is to examine the effects of randomized workplace interventions on PA behavior and/or cardiovascular fitness. A search based on PRISMA-P standards was conducted using Medline via PubMed, CINAHL, and Cochrane Library databases. Studies were analyzed according to supporting theory, technology used, intervention method and dose, and intervention effect. Twenty-five studies were identified. Theory-supported interventions were more likely to report significant effects. Interventions were either technology-delivered, person-delivered, or a combination of both methods. Significant effects on PA behavior and/or fitness were found among all three intervention types. Most interventions with significant effects were delivered over 10 – 16 weeks and had at least weekly contacts with participants. Reporting on paid work time for interventions was limited and inconclusive. Theory supported, brief interventions using technology-delivered, person-delivered, or combined methods can be effective in increasing PA behavior or fitness. Detailed studies on paid vs. non-paid worktime PA are needed.

Background

Less than half of Americans over 18 years of age meet current physical activity (PA) guidelines of at least 150 minutes of moderate-level or 75 minutes of vigorous-level PA per week. With the majority of U.S. adults employed (“Bureau of Labor Statistics Data,” n.d.) and the average workday lasting nearly nine hours (“American Time Use Survey Home Page,” n.d.), the workplace has been identified as an important place to intervene to promote health and prevent disease (“Worksite Physical Activity | Physical Activity | CDC,” n.d.).

Prior reviews of workplace PA behavior interventions report positive effects on PA behavior, fitness, and biometric measures. However, studies in these reviews largely used self-report methods to assess PA behavior (Conn, Hafdahl, Cooper, Brown, & Lusk, 2009a; Dugdill, Brettell, Hulme, McCluskey, & Long, 2008; Malik, Blake, & Suggs, 2014). Self-report PA is problematic in that participants frequently overestimate their activity levels (Prince et al., 2008). The most recent review of workplace PA interventions, published in 2014, included studies published up to April 2011 (Malik et al., 2014). Since 2011, wearable fitness technology has become more available, affordable, and trendy (Hughes, 2015). Yet, the effectiveness of wearable technology for improving PA behavior or fitness remains unclear.

One of the earliest reviews of workplace PA interventions studies was a meta-analysis conducted by Dishman et al. (Dishman, Oldenburg, O’Neal, & Shephard, 1998). This review of 26 studies published between 1972 and 1997, reported a small positive mean effect ($r = 0.11$) on PA behavior and/or cardiovascular fitness. Since the Dishman et al. (Dishman et al., 1998) review, at least four meta-analyses and four systematic reviews of workplace PA intervention studies have been published with most also reporting small positive intervention effects on both PA behavior and fitness (Abraham & Graham-Rowe, 2009; Conn et al., 2009a; Hutchinson & Wilson, 2012; Malik et al., 2014; To, Chen, Magnussen, & To, 2013; Verweij, Coffeng, van Mechelen, & Proper, 2011). Only one systematic review was found that reported positive intervention effects on PA behavior, but not on fitness (Proper, Koning, et al., 2003).

Collectively, prior reviews of workplace PA studies indicate several factors that may enhance the intervention effect. First, in randomized trials a larger mean effect size was observed in experimental groups compared to control groups using post-intervention data ($d = 0.12$ vs. $d = 0.07$) and change over time data ($d = 0.91$ vs. $d = -0.04$) (Hutchinson & Wilson, 2012). Next, two reviews found a higher mean intervention effect when an objective fitness measure was used compared to a self-report PA measure (Conn et al., 2009a; Hutchinson & Wilson, 2012). The largest intervention effects for self-report PA was 0.21 and for objective fitness measures, 0.57 (Conn et al., 2009a). Lastly, workplace PA intervention studies often target multiple health behaviors at once, with most focusing on diet and exercise (Malik et al., 2014). There is evidence however, to support limiting interventions to addressing one health behavior at time (Abraham & Graham-Rowe, 2009; Hutchinson & Wilson, 2012).

Lastly, a major critique of studies published on workplace PA interventions is the lack of a specified theoretical foundation for the intervention. Interventions with clear linkages to the supporting theory or conceptual framework is necessary to explain the intervention effect (Conn, Cooper, Ruppar, & Russell, 2008; Conn, Rantz, Wipke-Tevis, & Maas, 2001; Dishman et al., 1998). Two prior reviews report 12% to 60% of studies reviewed, described the theory supporting the intervention (Malik et al., 2014; To et al., 2013). Additionally, theories may differ in their effect. One meta-analysis found the theoretical approach for workplace PA interventions with the largest effect size post-intervention was social influence ($d = 0.19$) and over time (6 months) was motivation enhancement ($d = 1.98$) (Hutchinson & Wilson, 2012). This suggests the intervention effect is influenced by not only the type of theoretical approach, but also the time point at which the effect(s) can be achieved.

Many workplace intervention studies target healthy behaviors, particularly weight-loss (Thorndike, 2011; Verweij et al., 2011). However, “fitness” is more influential on morbidity and mortality than “fatness” (Barry et al., 2014). As such, the focus of this review was fitness and PA behavior, not weight-loss or weight management. Workplace PA intervention studies also often

target sedentary time through the promotion of standing and/or low intensity walking or movement. Because moderate-level aerobic activity is needed to achieve health benefits, this review focused on interventions recommending at least moderate-level PA. The purpose of this systematic review of workplace PA intervention studies was to evaluate randomized design studies published since the surge in personal fitness technology. Evaluation was guided by elements of well-described interventions (Conn et al., 2008) and intervention effectiveness on the primary outcomes of cardiorespiratory fitness and/or PA behavior.

Methods

Literature Search Strategies

This review followed the PRISMA-2015 protocol for conducting and reporting a systematic review (Moher et al., 2015). Medline via PubMed, CINAHL, and Cochrane Library electronic databases were searched using the phrases “physical activity” and “intervention” with “clinical trial”, “worksite”, and “workplace” to yield 856 abstracts. Studies were then screened using the filters of: published in English, on human adults, and published since 2002. Titles and abstracts of 402 publications were reviewed. Studies were retained for analysis using the following inclusion criteria: a) study design used random group assignment, b) intervention was completed at the workplace, and c) PA or cardiovascular fitness was a primary outcome. Studies were excluded if the primary objective was weight-loss, weight management, or to reduce sitting time.

Analysis

The PA workplace interventions were examined using a coding scheme developed to evaluate the completeness of intervention descriptions (Conn et al., 2008). Coding elements used were: type of intervention, theory/conceptual framework, interventionist, delivery mode, dose, and social context (Table 1).

Each study was reviewed for the presence or absence of attributes detailing the intervention. To determine dose of an intervention, time and contacts with the interventionist

and/or intervention were quantified. Data on technology trade names for wearable activity monitors, software, and web applications were collected. Intervention outcomes of PA behavior and fitness were then characterized as subjective (self-report) or objective (device-measured).

Results

Twenty-five randomized workplace PA intervention studies with PA behavior or cardiovascular fitness as a primary outcome were identified (Table 2). Studies were published between 2002 and 2016. Studies were often delivered in more than one workplace and less than half were conducted within the United States. Few studies were gender specific, including only women (Campbell et al., 2002; Purath, Michaels Miller, McCabe, & Wilbur, 2004; Ribeiro, Martins, & Carvalho, 2014) or only men (Gram, Holtermann, Sjøgaard, & Sjøgaard, 2012; Maruyama, Kimura, Okumura, Hayashi, & Arao, 2010). Across the 20 studies including both men and women, more participants were women (women $n = 6,197$; men $n = 3,472$).

Most studies used a two-group design with a control and experimental group and several used two or more experimental groups with a control group. Of the 16 studies using a control and experimental group, four studies delivered parts of the experimental group activities to the control group. Lack of a true control condition may have contributed to mixed or non-significant intervention effects among studies where the control group received information on the health benefits of PA, pedometer, heart rate monitor, and/or results from baseline fitness testing.

Most studies assessed participants at baseline and post-intervention and a few reported over-time outcomes at three (Ribeiro et al., 2014), four (Sternfeld et al., 2009), five (Slootmaker, Chinapaw, Schuit, Seidell, & Van Mechelen, 2009), and six (Aittasalo, Rinne, Pasanen, Kukkonen-Harjula, & Vasankari, 2012; McEachan et al., 2011) months post-intervention. Only one study reporting over-time outcomes found statistically significant intervention effects in subjectively measured PA behavior at four months post-intervention (Sternfeld et al., 2009). It is important to note nearly half the studies in this review ($n = 11$, 44%) measured PA behavior with subjective self-report questionnaires. Seven studies used only objective measures (pedometer) or

fitness (cycle, treadmill, or step test). Seven studies used both subjective and objective measures of PA behavior and/or fitness. Over half of the studies had a significant intervention effect on PA behavior, fitness, or both.

In this review, type of intervention was categorized as: a) psychosocial/behavioral, b) wearable device/technology, and c) combined psychosocial/behavioral and wearable device/technology. Most studies ($n = 15$, 60%) used only psychosocial/behavior intervention strategies. Several studies used a wearable device in combination with psychosocial/behavioral strategies. No studies used a wearable device solely to affect patient outcomes. However, several studies did use only technology (email, web-based support).

Studies varied in reporting on who delivered the intervention to participants. Interventionalists were described as researcher, exercise specialist, nurse, or trained individual from the worksite. Studies using only print materials, email, web-based platform, or provision of resources for PA (gym membership, paid time to exercise) were characterized as not having an interventionalist.

Four topics emerged as important to workplace PA intervention studies because of the association with positive intervention effects on PA behavior or cardiovascular fitness: theoretical foundation, intervention delivery mode, intervention dose, and social context of the study.

Theoretical Foundation

Of the 25 studies reviewed, 15 described at least one theory or conceptual framework to support the intervention. Transtheoretical model was the most frequently cited theory, followed by social cognitive theory and goal setting theory. Studies with significant intervention effects were more likely to have described a theoretical foundation ($n = 10$ vs. $n = 6$).

Most studies without a theoretical description were published in the last eight years. Additionally, the interventionalist was often an exercise specialist, or could not be identified due to missing information. Some studies without theory did have significant intervention effects on

fitness, or measured PA behavior. However, without linkage to the supporting concept or theory, interpretation of the intervention effect is limited.

Intervention Delivery Mode

Few studies ($n = 5$, 20%) could be characterized as solely technology-delivered, however most reported significant positive intervention effects on fitness (Andersen et al., 2013; Sliotmaker et al., 2009) or self-report PA behavior (Plotnikoff, McCargar, Wilson, & Loucaides, 2005). These “high-tech” interventions were delivered without human interaction, using instead email or calendar prompts, web-based tailored advice, and activity trackers. Wearable technology used to track activity included step counter, pedometer, heart rate monitor, and activity monitor with PC software. No studies described use of advanced multi-axial accelerometers commonly used by US adults today such as a Fitbit, Jawbone or Garmin Vivoactive (Webb, Joseph, Yardley, & Michie, 2010). Of the ten studies including wearable technology, four reported significant effects on fitness (Pressler et al., 2010), PA behavior (Dishman, DeJoy, Wilson, & Vandenberg, 2009; Ribeiro et al., 2014), or both (Barene et al., 2014). The effect of wearable PA technology in workplace studies remains unclear as no studies evaluated them as a single intervention component.

Several interventions ($n = 9$, 36%) combined technology-based and person-delivered methods. In these “high-tech plus high-touch” studies, participants met with an interventionalist (researcher, exercise expert, nurse or trained peer) and received encouraging email messages to increase PA, web-based self-monitoring, prompting or tailored advice. Prompting PA via email or electronic calendar does appear to be effective whether used alone (Andersen et al., 2013; Plotnikoff et al., 2005; Sternfeld et al., 2009) or in combination with other high-touch methods (Gazmararian, Elon, Newsome, Schild, & Jacobson, 2013; Pressler et al., 2010; Talbot et al., 2011). Likewise, other effective intervention combinations were: activity monitor plus supervised group training, pedometer plus goal setting with peer, and web-based self-monitoring plus individual training sessions. Of the nine studies using high-tech plus high-touch methods, over

half reported a positive intervention effect on fitness (Pressler et al., 2010), PA behavior (Dishman et al., 2009; Gazmararian et al., 2013; Ribeiro et al., 2014) or both (Barene et al., 2014).

Ten studies were considered “no tech” because interventions were delivered without the use of email, web-based platforms, or wearable activity monitors. These “high-touch” methods used supervised exercise, and/or individual counseling sessions with a nurse, nurse practitioner, exercise specialist, and/or peers trained to organize and encourage activities for PA. One study used neither high-tech or high-touch methods, using instead paid time for exercise as a key component of the intervention (von Thiele Schwarz, Lindfors, & Lundberg, 2008). Studies using high-touch methods were effective with individual informational sessions (Proper, Hildebrandt, Van der Beek, Twisk, & Van Mechelen, 2003; Purath et al., 2004), supervised training (Atlantis et al., 2006; Dalager, Justesen, Murray, Boyle, & Sjøgaard, 2016; Gram et al., 2012), peer-led group PA activities (McEachan et al., 2011), and self-selected partner for PA (Prestwich et al., 2012).

All intervention delivery methods (high-tech, high-touch, tech-touch combination), had positive intervention effects on PA behavior or fitness but slightly more often with high-touch interventions (7/10, 70%), followed by high-tech interventions (3/5, 60%), and tech-touch combination interventions (6/10, 60%). This ranking may be explained by an attenuation of intervention effects when more than one strategy (i.e., technology and person delivered strategies) for behavior change are used within the same intervention. It is interesting to note, most interventions with non-significant effects used only self-report measures of PA behavior and/or a low-tech pedometer to objectively measure PA behavior. Self-report PA behavior measures and pedometers may not be sensitive enough to detect an intervention effect.

Intervention Dose

Time is an important concept with respect to intervention dosing and includes: duration of intervention, time spent receiving the intervention, and time spent engaged in the desired health

behavior. In this review studies were as short as 6 weeks and as long as 18 months, with most lasting 2.5 to 4 months. Of the fourteen studies lasting 4 months or less, most ($n = 11$, 79%) reported a significant increase in subjective PA, objective PA and/or objective fitness. Eleven interventions were longer than four months, and only a few reported significant intervention effects at six (Atlantis et al., 2006; Prestwich et al., 2012), nine (Gazmararian et al., 2013; Proper, Hildebrandt, et al., 2003), and twelve months (Dalager et al., 2016).

Time spent receiving the intervention was difficult to determine with technology-based interventions. No studies reported participant time spent reading emails, interacting with a tailored-web site, or using web-based self-monitoring. Studies using email messages did report the number of messages and schedule of messaging. Two studies used pedometers with PC software; one used self-report to capture time spent wearing the pedometer (Slootmaker et al., 2009) and another reported number of log-ins to the pedometer's website (Reijonsaari et al., 2012). Although technology-delivered intervention components were varied and vague on participant interaction time, brief email messaging appears to be effective as a stand-alone method. Two studies used only email messages to significantly increase self-report PA behavior (Plotnikoff et al., 2005) or fitness (Andersen et al., 2013). One study sent 10 weekly messages to walk the stairs 10 minutes per day (Andersen et al., 2013) and another sent 12 weekly general messages on PA (Plotnikoff et al., 2005). Conversely, unlimited access to web-based tailored advice did not have significant intervention effects (Marshall, Leslie, Bauman, Marcus, & Owen, 2003; Slootmaker et al., 2009). Most well described interventions with significant intervention effects had at least weekly contacts with participants for part, or all the intervention through email, training, group meetings, web-program, or telephone counseling.

In contrast to technology-delivered interventions, person-delivered interventions commonly reported on the number of sessions and/or minutes participants spent in individual and/or group sessions with an average of three to six individual and/or group sessions on PA. Several person-delivered interventions were effective with use of more time-intensive methods of

supervised training with a fitness expert. Two studies reported a significant increase in fitness with as little as 36 to as many as 72 supervised training sessions (Atlantis et al., 2006; Gram et al., 2012). Under-reporting of training session attendance across studies makes it difficult to determine why other studies with supervised training did not have a significant intervention effect.

Lastly, reporting on participant time spent in the desired health behavior of PA varied across studies. Most studies estimated time engaged in PA using valid and reliable self-report measures or researcher developed questionnaires. Two studies used a pedometer to objectively assess time spent in PA with pedometer for seven days at baseline and post-intervention (Ribeiro et al., 2014) or weekly upload of pedometer data (Maruyama et al., 2010). A few studies using only objective measures reported on attendance of training sessions, and leisure time PA.

Of note, studies with control and intervention groups, using both subjective and objective outcome measures, had similar findings between measures. That is, there was either a significant effect (Dalager et al., 2016; Pedersen et al., 2009; Proper, Hildebrandt, et al., 2003) in both subjective and objective measures or a non-significant effect (Aittasalo, Mäkelä, & Suni, 2004; Pedersen et al., 2009; Slootmaker et al., 2009) in both the subjective and objective measures. In these few cases, self-reported time engaged in PA corresponded with the measured fitness level.

Social Context of the Study

Factors influencing the social context of workplace interventions include whether study activities occur at the workplace and if the intervention and/or expected behavior occurred on paid work time. All studies included in this review had aspects of participation that were both conducted in the workplace and time intensive. Studies were reviewed for indications of participation while on paid work time (paid-time studies) to attend introductory sessions, individual or group counseling sessions, group PA events, read health promotion/prompting emails, or complete web-based goal setting and self-monitoring tracking. Less than half of

studies gave clear indication if the intervention was delivered on paid work-time (Andersen et al., 2013; Dalager et al., 2016; Gazmararian et al., 2013; Gram et al., 2012; Pedersen et al., 2009; von Thiele Schwarz et al., 2008) or non-paid work-time (Barene et al., 2014; McEachan et al., 2011; Plotnikoff et al., 2005; Ribeiro et al., 2014).

One paid-time study with positive effects used a tech-based intervention: email prompts to walk the stairs 10 minutes daily (Andersen et al., 2013). Three paid-time studies used “high-touch” person-delivered interventions including individual training or supervised group training sessions. One paid-time study was neither high-tech or high-touch as participants were randomized to one of three groups: a) assessment only, b) paid 150 min/week mandatory exercise group, or c) paid 150 min/week reduced work hours group (von Thiele Schwarz et al., 2008). Participants paid to exercise 150 minutes per week reported significantly more PA than participants who had the equivalent time in reduced work hours and the control group.

Paid PA time during the workday was not a prerequisite for a significant effect. Three unpaid interventions reported significant intervention effects on subjectively measured PA (Plotnikoff et al., 2005), objectively measured PA (Ribeiro et al., 2014), and fitness (Barene et al., 2014).

The sample of studies with a clear indication of paid status is too small to reasonably conclude if workplace PA interventions should be conducted during paid work time. While non-paid interventions can have success, there is evidence to support paid work time interventions from as little as 10 minutes of paid stair walking per day (Andersen et al., 2013) to 30 minutes of exercise per workday (Gazmararian et al., 2013; von Thiele Schwarz et al., 2008).

Discussion

The purpose of this review was to systematically review randomized design workplace PA intervention studies to include those published since the surge in technology supporting healthy PA behavior. Guided by elements of well-described intervention studies (Conn et al.,

2008) and intervention effectiveness, this review identified four specific areas important for future workplace PA interventions.

First, a clearly described theoretical foundation for the intervention is important but often missing from publications. Prior reviews report theoretical descriptions as low as 12% (Malik et al., 2014) to as high as 60% (To et al., 2013). This review adds to prior reviews by including workplace PA intervention studies published between 2012 and 2016. The theoretical description rate for this review was high, by comparison ($n = 15$, 60%). However, those without theoretical description were published recently, within the last eight years. This trend away from including theory is particularly noted among those studies using technology (emails, websites, pedometer) to deliver the intervention.

Across studies, a positive intervention effect on PA behavior or fitness was more likely with a theory-supported intervention. This is consistent with health behavior research conducted outside the workplace. Webb (Webb et al., 2010) reported greater effect sizes for internet-based interventions with an extensive theoretical foundation, particularly with the theory of planned behavior. Authors should attend to and describe the theory or concepts supporting their intervention even if the intervention is predominately technology based. Theoretical foundation is necessary for explaining the intervention effect.

A second important finding centers on intervention delivery mode and methods used to assess intervention outcomes. Advances in wearable fitness tracking and web-based health behavior technology have not yet penetrated workplace PA intervention research. While a few studies using uni-axial accelerometers were found, no randomized intervention studies were found using more advanced multi-axial accelerometers or smart phone activity trackers. Consumer-grade multi-axial accelerometers with supporting training software have been available for the past 10 years. Few studies in this review, using wearable technology, reported significant positive intervention effects. This may be because the wearable technology was predominately low-tech step counters and pedometers. In addition, wearable technologies were

part of multi-component interventions making it difficult to know what, if any, direct impact the wearable technology had on outcomes.

Among healthy adults outside the workplace, there is evidence from randomized studies that wearable technology (activity tracker, mobile phone, web-based self-monitoring) favorably and significantly affects PA behavior (Webb et al., 2010). Workplace PA intervention research needs more evidence from studies testing wearable technology as a single intervention component in addition to using it in multi-component interventions. Technology using email and/or web-based messaging has been evaluated in single-component workplace PA interventions and the positive intervention effects supports its use in future research (Andersen et al., 2013; Plotnikoff et al., 2005; Sternfeld et al., 2009).

Whether interventions are predominantly person-delivered, technology-delivered, or a combination of both, it is also important to consider the outcome measure. Self-report PA behavior is not as sensitive as objective fitness testing and participants tend to overestimate their PA levels, reducing the reliability of this measurement method. Self-report measures in this review were less likely to report significant intervention effects. This is consistent with prior reviews reporting larger PA intervention effect sizes when objective measures of fitness were used compared to subjective measures of PA behavior (Conn et al., 2009a; Hutchinson & Wilson, 2012). The effectiveness of a PA workplace intervention using only subjective outcome measures should be considered with reservation.

An important finding of this review is the issue of time in dosing workplace interventions. Constraints on study resources and issues of participant and employer burden call for evidence to support time spent delivering an intervention. This review found workplace PA interventions lasting 10 to 16 weeks with weekly participant contacts, adequate for affecting post-intervention PA behavior and/or fitness. Likewise, several interventions with significant effects used brief strategies such as 5 to 20 minute PA coaching sessions provided in-person and/or over the phone (Proper, Hildebrandt, et al., 2003; Purath et al., 2004; Ribeiro et al., 2014) or weekly

email prompts to be active (Andersen et al., 2013; Plotnikoff et al., 2005; Sternfeld et al., 2009; Talbot et al., 2011). Workplace PA interventions do not have to be time intensive to have favorable short-term effects. However, evidence of long-term effects is needed and few studies in this review collected over-time data beyond conclusion of the intervention.

Another intervention dosing issue is time spent delivering/receiving the intervention, particularly among studies using technology (email, pedometer, website). Few studies described participant time spent wearing pedometers, reading emails or navigating websites promoting PA behavior. This intervention dosing detail is key to replicating studies or developing workplace PA behavior change programs. Qualitative description of participants' experience with technology to increase PA behavior may better address this knowledge gap than relying on intervention studies to describe interaction time with technology components of interventions.

The workplace as a social context is the final important point of this review. Over half (14, 56%) of the studies in this review did not report whether the intervention or the expected PA behavior was on paid work time or not. A prior meta-analytic review of workplace PA interventions reported a larger mean effect size on fitness for paid work-time interventions compared to non-paid work-time interventions ($d = 0.92$ vs. $d = 0.49$, respectively) (Conn et al., 2009a). This review found too few studies to recommend for or against using paid work-time to deliver a PA intervention. There were significant intervention effects among both paid and non-paid interventions. Future studies and reviews are encouraged to report on the paid work-time status of interventions. This is a particularly important detail for: permissible employee work-time behavior, employers agreeing to research conducted in their organization with their employees, studies looking to reproduce methods in a different population, and finally for the development of evidence-based practice.

Limitations

Some publications meeting the search criteria for this review may have been missed due to: a limited number of search terms and combination of terms, a single author screening titles

and abstracts for studies of interest, and search of only three major electronic databases. More studies may have been found if specific technologies of interest were added to the search terms. Review of studies was restricted to the elements of intervention coding instrument. Additional important aspects of conducting workplace of PA intervention research may have been identified had the frame of review been broader.

Conclusions

A variety of methods used to increase PA behavior using the workplace are effective. Interventional researchers have been successful with technology-delivered, person-delivered, or a combination of both tech and touch methods. However, this review did not find advanced activity trackers and mobile applications commonly available today used in intervention studies published through 2016. Intervention descriptions across workplace PA interventions often lacked detail. Details about time to deliver the intervention, time engaged in the health behavior, and if the intervention should occur on paid work-time or not, is needed for future research and/or health programming development.

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Table 1. *Intervention Coding Elements*

Type of Intervention		
Psychosocial/behavioral		
Device efficacy		
Psychosocial/behavioral plus device		
Interventionalist		
Researcher		
Nutrition expert		
Exercise expert		
Peer		
Conceptual/Theoretical Framework		
Described		
Linked to intervention		
Delivery Mode		
No Tech/Touch	High-Tech	High-Touch
Newsletter	Wearable device	In-person individual
Postal Mail	Email	In-person group
	Web-based	Telephone
	Software/application	
	CD/DVD	
Dose		
Duration of intervention		
In-person time with interventionalist		
Number of contacts with interventionalist		
Number of mailings		
Number of emails		
Number of web contacts		
Social Context		
Intervention time paid/unpaid		
Behavior expected at work/away from work		

Table 2. Summary of Randomized Workplace Physical Activity Intervention Studies

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Aittasalo et al. (2004)	155 68 M 87 F	9 Industrial companies Finland	TTM PRECEDE-PROCEED Model	12	Occupational Health Nurse Physio-therapist	Control Group Pedometer plus 7-day PA diary of PA at baseline, 6 and 12 months Counseling Group Individual sessions (4) (time NR) Counseling + fitness testing Group Individual sessions (4), 2Km Walk test, strength and balance testing (3) with individual results counseling (270 min) Control Group Questionnaire assessment of PA at baseline, 2, 6, and 12 months STEP Group Pedometer Group session (1) (60 min), monthly email messages (6)	Pedometer Yamax Digi-walker SW-700 for outcome measure, intervention	NR	Subjective PA -revised IPAQ -No statistically significant group differences at 6 and 12 months in min of moderate to vigorous leisure time PA Objective PA -pedometer -No statistically significant group differences at 6 and 12 months in steps per day
Aittasalo et al. (2012)	241 76 M 165 F	20 Offices Finland	RE-AIM	6	Researcher	Control Group Weekly reminder to continue usual PA Email Group Weekly email messages to walk stairs 10 minutes daily (10) Wait-list Control Group No counseling, health education or discouragement from increasing PA levels Intervention Group Diet and PA information group sessions (5), individual diet and PA counseling sessions (6) (360 min), supervised aerobic and strength training sessions (minimum 72 with 7 sessions 1:1 with supervisor)	Pedometer Omron Walking Style II	NR	Subjective PA - revised IPAQ -STEP group non-significant increase in weekly min at 2 and 6 months No group differences at 12 months -STEP group non-significant increase in number walking for transportation at 2 months, walking for leisure at 6 months, and walking stairs at 2, 6, and 12 months
Andersen et al. (2013)	160 35 M 125 F	1 Office Denmark	NR	2.5	No	Control Group Weekly reminder to continue usual PA Email Group Weekly email messages to walk stairs 10 minutes daily (10) Wait-list Control Group No counseling, health education or discouragement from increasing PA levels Intervention Group Diet and PA information group sessions (5), individual diet and PA counseling sessions (6) (360 min), supervised aerobic and strength training sessions (minimum 72 with 7 sessions 1:1 with supervisor)	None	Yes 10 min/day to walk stairs	Objective Fitness -maximal cycle test -Email group significant increase in VO_{2max} compared to control at 2.5 months
Atlantis et al. (2006)	73 36 M 37 F	1 Casino Australia	Behavior Modification	6	NR	Control Group Weekly reminder to continue usual PA Email Group Weekly email messages to walk stairs 10 minutes daily (10) Wait-list Control Group No counseling, health education or discouragement from increasing PA levels Intervention Group Diet and PA information group sessions (5), individual diet and PA counseling sessions (6) (360 min), supervised aerobic and strength training sessions (minimum 72 with 7 sessions 1:1 with supervisor)	None	NR	Objective Fitness -single stage maximal treadmill test -Intervention group significant increase in VO_{2max} compared to wait-list control at 6 months

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Barene et al. (2013)	118 11 M 107 F	1 Hospital Norway	NR	3	Exercise specialist	<p>Control Group Assessments only</p> <p>Zumba Group Supervised group training 2-3 times per week (24-36) (1440-2160 min)</p> <p>Soccer Group Supervised training group 2-3 times per week (24-36) (1440-2160 min)</p> <p>Delayed Intervention Group Print tailored diet and PA education (1)</p>	Heart rate monitor Polar	No	<p>Objective Fitness-submaximal and exhaustion cycle ergometer test</p> <p>-Zumba and soccer groups significant increase in relative VO_{2peak} compared to control group at 3 months</p> <p>-Zumba group significant decrease in average heart rate during cycle test compared to control group at 3 months</p>
Campbell et al. (2002)	538 0 M 538 F	9 manufacturing worksites United States	SCT TTM SS	18	Trained individual from worksite	<p>Intervention Group Print tailored diet and PA 6 months apart (2), Natural Helpers (n = 13 - 36/worksites) individuals from worksite trained to educate peers, start walking groups</p>	None	Assessments only	<p>Subjective PA-researcher developed questionnaire</p> <p>-No significant group differences in frequency of aerobic behavior at 6 and 18 months</p> <p>-Intervention group significantly more strengthening and flexibility exercise at 6 months</p>
Dalager et al. (2016)	387 101 M 286 F	6 Offices Denmark	IPET	12	Exercise specialist	<p>Control Group Maintain current lifestyle</p> <p>Training Group Weekly individual sessions with trainer (3,120 min) encouraged to engage in moderate level activity 30 min/day, 6 days/week</p>	None	Yes	<p>Subjective PA-self-report days of light, moderate, and vigorous PA in sub-sample (n = 133)</p> <p>-Training group significant increase in number of active days and time spent in vigorous activity compared to control group at 12 months</p> <p>Objective Fitness-cycle ergometer test</p> <p>-Training group significant increase in VO_{2max} compared to control group at 12 months</p>
Dishman et al. (2009)	1442 447 M 995 F	20 worksites for one large retail company U.S. and Canada	GST	3	Trained individual from worksite	<p>Control Group Health risk appraisal, monthly newsletter on health benefits of PA (3)</p> <p>Intervention Group Pedometer Print goal-handbook (1), in-person PA reporting/goal setting interaction with peer (6)</p>	Pedometer Yamax SW-200 Intervention group only	NR	<p>Subjective PA-IPAQ</p> <p>-Intervention group significant increase in minutes walking and moderate and vigorous PA compared to control group at 1.5 and 3 months</p> <p>Objective PA-pedometer</p> <p>-Intervention group mean daily step count exceeds 9,000 steps at 3 months</p>

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Gazmararian et. al (2013)	410 156 M 254 F	1 University U.S.	SCT	9	No	<p>Group 1: Control Assessments only</p> <p>Group 2: Gym Gym membership 1 year</p> <p>Group 3: Gym + Education Gym membership plus weekly mailed/emailed PA education (36), website with PA resources, walking map of campus, PA log book, peer-led walking groups</p> <p>Group 4: Gym + Time Gym membership plus 30 min paid exercise time per workday</p> <p>Group 5: Gym + Education + Time Gym membership plus weekly mailed/emailed PA education (36), website with PA resources, walking map of campus, PA log book, peer-led walking groups, plus 30 min paid exercise time per workday</p>	None	5400 min max in Group 4 and 5	<p>Subjective PA-7-day PA Recall (PAR) tool -Group 3, 4, and 5 significant increase in number of days meeting guidelines for adequate PA compared to control at 9 months</p>
Gram et al. (2012)	67 67 M 0 F	3 Construction companies Denmark	NR	3	Exercise specialist	<p>Control Group Lecture on general health promotion (60 min)</p> <p>Exercise Group Tailored aerobic and strength training program, individual supervised exercise sessions (36) (720 min)</p>	None	Yes	<p>Objective Fitness-sub maximal cycle ergometer test -Exercise group significant increase in VO_{2max} compared to control at 3 months</p>
Marshall et. al (2003)	655 318 M 337 F	1 University Australia	TTM	4	No	<p>Print Group Print booklet (1), tailored letters every 2 weeks (4)</p> <p>Web Group Web based tailored advice (unlimited), email messages every 2 weeks (4)</p>	None	NR	<p>Subjective PA- IPAQ -No significant group differences in moderate and/or vigorous PA or in walking time at 2 months. Both groups increased PA time</p>

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionalist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Mariyama et al. (2010)	101 M 101 F	1 Health insurance association Japan	SCT GST	4	Exercise specialist and Dietician	Control Group Pedometer and assessments Intervention Group Pedometer, monthly individual sessions with dietician (3) (40 min) and trainer (3) (30 min), web-based self-monitoring and messages (NR)	Pedometer Walking style HJ-7101T Omron	NR	Objective PA -pedometer -No significant group differences in number of weekly steps at 4 months
McEachan et al. (2011)	1260 574 M 686 F	44 worksites Transportation, Government office, Hospital, University United Kingdom	TPB SCT Modeling	3	Trained individual from worksite	Control Group Assessments only Intervention Group Trained peers (1-2 per worksite), mass media to relay monthly informational messages about benefits of PA, encouragement and self-monitoring instruction plus peer-led organized group PA activity	None	No	Subjective PA -IPAQ -No significant group differences in moderate or vigorous PA at 3 and 9 months Objective Fitness -resting heart rate in sub sample (n = 1,029) -Intervention group with significant reductions in resting heart rate compared to control group at 3 months
Pederson et al. (2009)	549 195 M 355 F	9 offices Denmark	NR	12	Exercise specialist	Reference Group (REF) General health topic presentations All Around Exercise Group (AE) Supervised group sessions (12-48), steppers and punch bags in workspace, group walking sessions (NR), 8 min CD-based exercise program, step counter “for some” Specific Resistance Training Group (SRT) Supervised individual strength training sessions (52)	Step counter AE Group	All groups 60 min per week for total of 3120 min	Subjective PA -IPAQ -No significant group differences in total PA or vigorous PA time at 6 and 12 months Objective Fitness -submaximal cycle ergometer test -No significant group differences at 12 months. Upward trend in VO_{2max} observed in AE group compared to SRT and RE group at 12 months
Plotnikoff et al. (2005)	2121 553 M 1,556 F	3 government and 2 private sector Canada	SCT TPB TTM PMT	3	None	Control Group Assessments only Intervention Group Weekly email messages on nutrition (12) and PA (12)	None	No	Subjective PA -Godin Leisure Time Exercise Questionnaire -Intervention group significant increase in total PA time at 3 months - Control group significant decrease in total PA time at 3 months -Both groups significant increase in workplace PA at 3 months

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionalist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Pressler et al. (2010)	140 125 M 15 F	1 Automobile manufacturer Germany	NR	3	NR	<p>Control Group (CG) Introductory group education session (1) (75 min), non-structured internet delivered exercise program, heart rate monitor, final group PA education session (1) (time NR)</p> <p>Intervention Group (IG) Introductory group education session (1) (75 min), heart rate monitor, structured internet delivered individual exercise program beginning with 3 moderate aerobic level 30 min workouts per week (48), electronic calendar/logging prompts (36), final group PA education session (1) (time NR)</p>	Heart rate monitor Polar FS2c	NR	<p>Objective PA-pedometer -No group differences in step count at 3 months</p> <p>Objective Fitness-anaerobic lactate threshold, peak oxygen uptake, peak ergometer performance, and heart rate during cycle ergometer -Control group and intervention group significant increase in anaerobic lactate threshold at 3 months -Intervention group significant increase in peak oxygen uptake compared to control group at 3 months -Control group with significant increase in peak ergometer performance compared to intervention group at 3 months -Intervention group with significant reduction in heart rate during cycle ergometer compared to control at 3 months</p>
Prestwich et al. (2012)	257 230 M 26 F	15 Government offices United Kingdom	II PMT	6	Participant selected peer CII and PO groups	<p>Control Group (CG) Directed to increase PA. Assessments at 1, 3, and 6 months</p> <p>Collaborative Implementation Intentions Group (CII) Print goal worksheet (1), directed to document specific plans to increase PA with a chosen partner</p> <p>Partner Only Group (PO) Directed to recruit partner to increase PA without completing a written plan</p> <p>Implementation Intentions Group (II) Print goal worksheet (1), directed to document a specific plan to increase PA as an individual</p>	None	NR	<p>Subjective PA-IPAQ and SWET -CII group significantly more PA than CG, PO, and II group at 1, 3, and 6 months</p>

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Proper et al. (2003)	299 46 M 162 F	3 different municipal services Netherlands	TTM	9	Physio- therapist	Control Group Print information on healthy lifestyle (1) Intervention Group Print information on healthy lifestyle (1), individual sessions on PA and nutrition (7) (140 min)	None	NR	Subjective PA -self-report number of days of moderate level PA >30 min/day in past 2 weeks, PAR, and Baecke questionnaire -Intervention group significantly greater total energy expenditure compared to control group at 9 months -Both groups no change in leisure time PA Objective Fitness -submaximal heart rate cycle ergometer test -Intervention group significantly decreased submaximal heart rate at 9 months -Control group significantly increased submaximal heart rate at 9 months
Purath et al. (2004)	287 0 M 287 F	1 University U.S.	TTM	1.5	Nurse Practitioner	Control Group Non-staged based health counseling with nursing and health promotion students Intervention Group Non-staged based health counseling with nursing and health promotion students plus individual session (1) (5 min) based on stage of change for PA, phone follow-up (1)	None	NR	Subjective PA -Paffenbarger PA questionnaire -Intervention group significant increase in blocks walked per day, vigorous and moderate weekend PA, walking minutes for PA and total weekly walking minutes compared to control at 1.5 months
Reijonsaari et al. (2012)	521 187 M 334 F	1 Insurance company Finland	NR	12	Exercise Specialist	Control Group Baseline fitness test (NR) results, print information on PA (1) Intervention Group Baseline fitness test (NR) results, print information on PA (1), activity monitor, Individual session (1) to load software and set PA goals, web based follow up messages/phone contacts from exercise specialist (max 26)	Activity Monitor PAM-200 with software	NR	Subjective PA -revised IPAQ -No significant group differences in MET min per week at 12 months

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionalist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Ribeiro et al. (2014)	195 0 M 195 F	1 University Hospital Brazil	NR	3	Researcher and exercise specialist	<p>Minimal Treatment Comparator (MTC) Group Monthly individual sessions (3) (45 min)</p> <p>Pedometer + Individual Counseling (PedIC) Group Pedometer, monthly individual sessions (3) (45 min)</p> <p>Pedometer + Group Counseling (PedGC) Group Pedometer, weekly group sessions (6) 2-week interval group sessions (2) (480 min), Group walking (8)</p> <p>Aerobic Training (AT) Group Bi-weekly supervised exercise sessions (24) (840 min)</p>	Pedometer Yamax Digiwalker SW-200 PedIC and PedGC groups	No	<p>Objective PA-total number of steps and min of moderate intensity PA using pedometer -PedIC and PedGC significantly increased step number with PedGC having the highest number of steps at 3 months -No group differences in step number at 6 months -PedGC significantly more moderate intensity PA at 3 months</p>
Slootmaker et al. (2009)	102 41 M 61 F	8 Offices Netherlands	NR	3	No	<p>Control Group Print information on PA recommendations (1)</p> <p>Intervention Group Activity Monitor, web-based tailored advice (unlimited access)</p>	Activity Monitor AM101 with software	NR	<p>Subjective PA- Activity Questionnaire for Adolescents and Adults -No significant group differences in minutes of light, moderate and vigorous PA at 3 and 8 months</p> <p>Objective Fitness-submaximal Chester step test -No group differences in predicted VO_{2max} at 3 and 8 months</p>
Stemfield et al. (2009)	788 203 M 585 F	1 Healthcare System U.S.	TRA SCT GST TTM SM	4	No	<p>Control Group Assessments only</p> <p>Intervention Group Weekly email messages (8) then Email messages every 2 weeks (4) Web-based tailored information, goal setting, self-monitoring tool</p>	None	NR	<p>Subjective PA-Adapted Cross-Cultural Activity Patterns Questionnaire -Intervention group significantly greater total MET min/week of PA, moderate PA min/week and vigorous PA min/week and less sedentary min/week compared to control at 4 and 8 months</p>

Author	Sample N/ Gender	Worksite Type/ Country	Theory	Duration (months)	Intervention- alist	Intervention (number of contacts) (total interventionist contact time)	Wearable Tech	Paid Time	Outcome Measure/Effect
Talbot et al. (2011)	156 70 M 24 F	2 Army National Guard locations U.S.	NR	6 Both groups 3 months conditioning then 3 months maintenance	NR	Traditional Army Fitness (TRAD) Group Introductory group session (1) (60 min) Print training workbook (1), Unsupervised training, brief phone prompt to attend monthly meeting (6), monthly meeting (6) Fitness For Life (FFL) Group Pedometer, weekly telephone counseling (< 5 min) (18) (90 min), weekly postcard mailings (12), monthly group meetings (6) (135 min)	Pedometer Yamax SW-200	NR	Subjective PA-PAR -TRAD and FFL groups non-significant increase in total PA at 3 months and non-significant decrease in total PA at 6 months Objective Fitness -step count and Army Physical Fitness Test (APFT) (push-ups, sit-ups and 2-mile run) -FFL group significantly more daily steps and decrease in 2-mile run time than TRAD group at 3 months -FFL group non-significant decrease in daily steps and TRAD group non-significant increase in daily steps at 6 months -FFL group and TRAD group no significant change in sit-up and push-up repetitions at 3 months and neither group sustained run times at 6 months
von Thiele Schwarz et al. (2008)	177 0 M 177 F	6 Dental Health offices Sweden	NR	12	None	Reference Group (R) Assessments only Physical Exercise Group (PE) 2.5 hours per week (2 different days) of paid moderate intensity PA weekly PA log submission to designated fellow employee Reduced Work Hours Group (RWG) 1- 2.5 hours of reduced paid work time per week based on FTE	None	7,800 min PE group	Subjective PA -researcher-developed questionnaire -No significant group differences at 6 and 12 months. All 3 groups increase PA with greatest increase in PE group

CBT=cognitive behavioral theory, F=female, GST=goal setting theory, IL=implementation intentions, IPAQ=International Physical Activity Questionnaire, IPET=Individually tailored physical exercise training, M=male, NR=not reported PA=physical activity, PAR=Physical Activity Recall, PMT=protection motivation theory, SCT=social cognitive theory, SDT=self-determination theory, SS=social support, SWET=self-report walking and exercise tables, TTM= transtheoretical model, TPB=theory of planned behavior, TRA=theory of reasoned action, RCT=randomized control trial

CHAPTER III: Manuscript 2

Feasibility and Effect of a Peer-Modeling Workplace Physical Activity Intervention for Women

Abstract

Most working women do not meet current guidelines for physical activity (PA). A 12-week study was piloted to test a workplace, peer-modeling PA intervention in physically inactive women. Employees from a health system were randomized to an attention control group (ACG) (n = 24) or an intervention group (IG) (n = 26). The ACG received general health information. The IG participated in six group sessions with an active peer-model, received an exercise prescription, and PA information. Pre and post measures were: PA (ActiGraph), VO2max (cycle ergometer), resting heart rate (HR), glucose, lipids, and cardiovascular risk. Using hierarchical linear modeling, no significant group by time effects were found. Both groups increased PA ($F [df = 1] = 11.4, p = .002$). Although non-significant, the IG had greater improvements in fitness (VO2max, HR) and cardiovascular risk (total cholesterol, triglyceride, LDL, calculated risk score) compared to ACG. Results support the need for a fully powered study.

Purpose

Less than 26% of working women in the U.S. meet current guidelines for at least 150 minutes of moderate-level aerobic physical activity (PA) and 2 days of muscle strengthening activities per week (Blackwell & Clarke, 2016). Most Americans (82%) do some, or all their work, at their workplace (“American Time Use Survey Home Page,” n.d.). As such, leading health organizations identify the workplace as an opportune setting for health behavior intervention (Fonarow et al., 2015).

Workplace interventions targeting PA behavior and cardiorespiratory fitness have been effective using supervised exercise/training, email prompts to take the stairs, and brief stage of change counseling (Rowland & Yates, 2017). In a few studies, peers help deliver parts of multi-component interventions by providing education, organizing, and/or leading group PA activities. Outside the workplace, PA interventions using peers for social support (tangible aid, information and emotional support) have been effective among children, older adults, and cardiac patients (Ginis, Nigg, & Smith, 2013). However, no workplace PA studies were found with peer-modeling as a central theoretical strategy. Consequently, within the workplace, the unique effects of peers to increase PA remains unknown.

Most workplace PA intervention studies use the transtheoretical model as the theory supporting the intervention (Rowland & Yates, 2017). Another effective and recommended strategy for health behavior change interventions is self-efficacy development (Artinian et al., 2010). Self-efficacy, a central concept of social cognitive theory, can be developed through prior success, verbal persuasion, physiologic feedback, and vicarious experience (Bandura, 1998). Self-efficacy (confidence in ability) can be increased through observing someone similar succeed or fail at a given task or behavior. This observational learning, also known as vicarious experience, increases confidence (Bandura, 1998), facilitates skill acquisition, and provides feedback (Schwarzer, 2008) by attending to the behavior of a model. Vicarious experience is rarely incorporated into PA behavior interventions (Ashford, Edmunds, & French, 2010a).

The purpose of this pilot study was to evaluate for the first time the feasibility and effectiveness of a 12-week workplace intervention to increase PA behavior among inactive women using active peers, compared to an attention control group. The study aims were to: 1) assess feasibility by evaluating the number of contacted/recruited participants, number of drop-outs, time for intervention delivery, amount of missing data, and adherence to the intervention, and 2) determine the effect of a peer-modeling workplace intervention on the primary outcome of cardiorespiratory fitness, and secondary outcomes of cardiovascular risk.

Methods

Design

This study used an experimental, randomized, two-group repeated measures (baseline and 12-week) design to evaluate the effect of a workplace, peer-modeling PA intervention. Eligible participants were randomly assigned to either the intervention group (IG) or the attention control group (ACG) using a statistician-generated random assignment schedule.

Setting and Sample

The study setting was a Midwestern health system with approximately 3,500 employees, 80% of whom are female. Participant inclusion criteria were: female employees between 19 and 65 years of age, worked at least 20 hours per week, and self-reported ≤ 60 minutes moderate or ≤ 20 minutes of vigorous PA per week. Exclusion criteria were: greater than moderate cardiovascular risk (Arena, Pescatello, Riebe, & Thompson, 2014), unable to complete cycle fitness testing, pregnancy, working night shift, participating in a weight management or exercise program, and taking a beta-blocker medication.

Using G*Power, (Faul, Erdfelder, Lang, & Buchner, 2007) sample size was determined under univariate RM-ANOVA within-between interaction (time*group effect), where $\alpha = .10$, two groups over two time points, a sample size of 50 has 80% power to detect an effect size of $f = .178$, which is equivalent to a (d) of .357. The alpha level used was appropriate for a preliminary study (Hertzog, 2008). The medium effect size was consistent with workplace PA interventions

using maximal oxygen consumption VO_{2max} to measure fitness outcomes (Conn, Hafdahl, Cooper, Brown, & Lusk, 2009b).

Intervention Development

The theoretical basis for the peer-modeling intervention was a combination of social comparison theory (self-improvement based on comparison to others) (Festinger, 1954) and self-efficacy theory (confidence in one's capabilities for a given behavior) (Bandura, 1998). In this study, active peers served as models for successful engagement in healthy PA. The peer-models were similar to participants in gender, age, occupation and family demands. This intervention was proposed to function by providing social comparison/vicarious experience opportunities with similar and successful peer-models to increase participant confidence, motivation, and practical knowledge for self-improvement with PA.

Seven physically active female employees from the study site were recruited, interviewed, and trained to present their personal story of living an active lifestyle. Each peer-model was asked to create a 20-minute PowerPoint presentation portraying their experience of maintaining a minimum of 150 minutes of \geq moderate level PA per week for at least the past six months. Each peer-model specifically described their motivation, barriers, facilitators, self-monitoring, goal setting, and technology used for PA. One peer-model presented per session except for the last session when two peer-models presented. Although there were only six sessions, a seventh peer-model was recruited in the event of a schedule conflict. Because no scheduling conflicts occurred, the extra peer-model presented at the last session.

Peer-model Intervention

Following baseline testing, IG participants were privately counseled by a nurse practitioner on the results of their cycle fitness test and given an exercise prescription.

The exercise prescription included: a) target (HR) range ($HR_{max} - HR_{rest} \times \% \text{ intensity desired} + HR_{rest}$), b) PA intensity based on cycle test results; 40 - 60% of $HR_{reserve}$ for low fit and 60 - 70% of $HR_{reserve}$ for moderately fit participants, c) instruction on rating of perceived exertion (RPE)

scale and encouragement to achieve a RPE of 12 to 15 for moderate level intensity PA (Borg, 1982), and d) goal to obtain at least 150 minutes of moderate level PA/week at prescribed target HR range and RPE range. Additionally, the IG was asked to submit weekly PA logs ($n = 12$) documenting PA type, minutes, peak HR, and RPE during moderate PA lasting at least 10 minutes.

Over the 12-week intervention, the IG met every other week for a total of six 45-minute group lunch and learn presentations at the workplace. Each IG session was 10 minutes on PA health benefits, 20 minutes of the peer-model presenting their PA PowerPoint story, and 10-15 minutes of the peer-model taking questions and discussing PA issues with participants. The IG was exposed to seven different peer-models.

Attention Control Intervention

The ACG met every other week for six 45-minute group lunch and learn presentations for 12 weeks at the workplace. The ACG received general health information on diet, cancer screening, stress management, and sleep. The ACG did not receive fitness test results or an exercise prescription and were asked to maintain their current level of PA during the study.

Measures

All measures were collected at baseline and repeated at 12 weeks post-intervention except for a demographic questionnaire; which was collected only at baseline (Appendix C). An advanced practice nurse investigator, trained in fitness testing, completed all assessments and collected questionnaires in the employee fitness center.

Cardiorespiratory fitness. Estimated VO_{2max} is an indicator of increased PA behavior and an accepted measure of cardiorespiratory fitness. A multi-stage submaximal cycle test using the Monark 827E ergometer (Monark Exercise AB, Vansbro, Sweden) was used to estimate VO_{2max} and metabolic equivalents (METs) (Arena et al., 2014). Following a 2-minute warm-up of low resistance pedaling (0.5 kg), participants maintained a pedaling speed of 50 rpm while resistance was increased by 0.5 kg every 3 minutes. The test was terminated when either 85% of

max HR was reached ($220 - \text{age}$) or the participant requested to stop. Using participants' age-predicted max HR and HR at the end of the last two stages completed, estimated $\text{VO}_{2\text{max}}$ was calculated using $\text{VO}_{2\text{max}} [\text{mL}/\text{kg}/\text{min}] = 1.8 \times \text{work rate} [\text{kg}/\text{m}/\text{min}]/\text{body mass} [\text{kg}]$. The estimated $\text{VO}_{2\text{max}} [\text{mL}/\text{kg}/\text{min}]$ for the highest work rate obtained was calculated using an equation advocated by the American College of Sports Medicine (Arena et al., 2014). The associated peak MET value was based on $\text{VO}_2 [\text{mL}/\text{kg}/\text{min}]$ divided by 3.5. One MET represents a level of resting metabolism and peak level is the extent that VO_2 was elevated during the last stage of exercise (Arena, et al., 2014). Resting HR was also measured before the cycle test as an indicator of cardiorespiratory fitness (Kang, Kim, & Ko, 2016).

Physical activity behavior. Moderate level and/or greater PA (≥ 3 METs) (Arena et al., 2014) was measured using a tri-axial accelerometer (ActiGraph GT3X, ActiGraph LLC, Pensacola FL, USA). At baseline and post-intervention, all participants were instructed to wear the monitor during wake time, on the hip for seven consecutive days. ActiLife software 6.10.2 (ActiGraph LLC, Pensacola, FL, USA) was used to evaluate PA data stored with the epoch interval set at 1 minute. Wear time validation parameters were: activity threshold of 10 counts/minute, minimum of 8 hours of wear time/day, and a minimum of 3 days of valid wear time/week. Activity levels were measured in counts per minute (cpm) and defined as: sedentary 0 – 99, light 100 – 1951, moderate 1952 – 5724, and vigorous ≥ 5725 (Freedson, Melanson, & Sirard, 1998). Average weekly time spent in moderate or greater PA, was calculated by the sum of moderate and vigorous PA minutes divided by number of valid wear days $\times 7$.

Blood glucose and lipids. Venous blood was collected after an eight hour fast. A CLIA and CAP certified laboratory analyzed serum glucose, total cholesterol, HDL, LDL and triglycerides using the Vitros 5600 analyzer (Ortho diagnostics, Raritan, New Jersey, USA) within

Lifetime cardiovascular risk. The Lifetime Cardiovascular Risk calculator (Lifetimerisk.org) was used to predict the 30-year risk of fatal and non-fatal cardiovascular

disease (Berry et al., 2012). To calculate risk using this tool, self-report variables collected were age, gender, history of diabetes, and current smoking status. Measured variables were total cholesterol, BMI, and fitness level in METs.

Procedures

This study was approved by the University's Internal Review Board (Appendix A) and the study site (Appendix B). Informed consent, questionnaires, blood collection, measurements, and exercise testing were completed in a private area of the study site's employee fitness center. Randomization occurred after baseline testing.

Analysis

Statistical Package for Social Sciences (SPSS) software (v. 24) (*Statistical Package for Social Sciences*, 2016) was used to analyze demographic and study variables for group by time interaction effects. Participants were examined on an intent-to-treat basis. Variables were first screened and then non-normally distributed variables (VO_{2max} , METs, cardiovascular risk, and ActiGraph measured PA) were log transformed. Analysis was initially planned with repeated measures ANOVA. Participant dropout (IG = 9; ACG = 3) prompted a change to hierarchical linear modeling to analyze group by time interactions for the primary outcome of cardiorespiratory fitness and secondary outcome of cardiovascular risk. Because this was a feasibility study, statistical significance was determined with a p -value $< .10$.

Results

At baseline the ACG and IG were similar in mean years of age (ACG $M = 43 \pm 8.8$; IG $M = 43 \pm 12.4$), predominately Caucasian, employed full-time, and married/partnered (Table 1). Compared to the ACG, more participants in the IG worked as clinical staff vs. non-clinical staff. The IG had slightly higher self-report and measured moderate PA/week compared to the ACG; however, estimated VO_{2max} , METs, and resting HR were nearly identical for both groups at baseline (Table 2).

Feasibility

Recruitment. A six-week recruitment/enrollment period mid-December through January, allowed the target sample size ($n = 50$) to be met (Figure 1). Using the organization's established communication methods (intranet, print newsletter, signage in occupational health office) to recruit potential participants, was effective and low cost. Employees with interest in the study emailed the PI ($n = 113$) with questions about participating. To facilitate enrollment four informational sessions about the study were held at the workplace. Reasons cited by interested employees for not participating were: schedule conflicts, inability to choose group assignment, too active for inclusion criteria, pregnant or planned pregnancy during study, and taking a medication that limits HR (beta-blocker).

Participation. Following informed consent, 52 women were randomized to either the ACG ($n = 26$) or the IG ($n = 26$). All participants completed baseline measures and post-intervention measures were completed by 92% ($n = 23$) of the ACG and 65% ($n = 17$) of the IG (Figure 1). Both groups had similar attendance rates for the six lunch and learn sessions (ACG $M = 4.2 \pm 1.7$; IG $M = 4.2 \pm 1.5$). An additional indicator of participation in the IG was submission rate of 12 weekly PA logs ($M = 8.3 \pm 1.5$). Of those in the IG who completed post-testing measures ($n = 17$), 65% ($n = 11$) had high level participation (≥ 4 sessions and ≥ 90 minutes PA/week) and 35% ($n = 6$) had moderate level participation (≥ 2 sessions and/or 30 to 90 minutes PA/week). Low level participation (≤ 1 session and/or ≤ 30 minutes PA/week) was characteristic of most of the IG participants who did not complete post-intervention fitness testing.

Retention. Post-intervention scheduling and completing of measures, particularly the cycle fitness test, was more challenging in the IG than the ACG. Only 65% ($n = 17$) of IG completed the post-intervention cycle fitness test compared to 92% ($n = 22$) of the ACG. Lunch and learn session attendance averaged 66% for both groups.

Outcomes

Primary outcomes. There were no significant group by time interactions for estimated VO_{2max} , METs, or resting HR. Although non-significant, the IG had greater improvement in

VO_{2max} (IG = 6.7%; ACG = 4.2%), METs (IG = 5.5%; ACG = 4.4), and resting HR (IG = -5.3%; ACG = -1.0%) compared to the ACG (Table 3).

Secondary outcomes. There were no significant group by time interactions for secondary outcome measures of cardiovascular risk (glucose, lipids, ActiGraph measured PA, and lifetime 30-year risk). Over time, both groups significantly increased PA ($F [df = 1] = 11.49, p = .002$) and decreased cardiovascular risk ($F [df = 1] = 6.550, p = .014$). Although not significant, there were improvements favoring the IG in lifetime cardiovascular risk (IG = -13.0%; ACG = -3.2%), total cholesterol (IG = -3.1%; ACG = 1.3%), triglyceride (IG = 6.6%; ACG = 30.6%) and LDL (IG = -2.7%; ACG = 0.3%) (Table 3). The IG had a greater drop in HDL than the ACG (IG = -4.3%; ACG = -0.5%).

Discussion

This is the first study found to use a randomized, two-group intervention design to affect PA behavior using vicarious experience (attention to someone successfully perform a given behavior with peer-models in the workplace). Vicarious experience of active working women, to favorably affect the PA behavior of inactive working women, shows promise as an intervention for PA behavior change.

A main finding of this study was that the PA intervention was feasible. Active peer-models were recruited and trained; participants were recruited, enrolled, and the intervention was delivered at the workplace. Higher dropout in the IG compared to the ACG could be explained by lack of participant readiness to change PA behavior. It is possible that while increasing PA behavior sounds appealing, making the behavior change may require more than participants were prepared to do. Several participants in the IG group cited lack of time for PA as the reason for not completing the study. In addition, it was more difficult to schedule those in the IG group with low-level study participation (session attendance and PA log submission), despite encouragement to complete post-intervention testing regardless of PA level during the study. This was not the case for the ACG and IG participants who had regular session attendance and PA log submission.

Early drop-outs and low-level participators in the IG may have been in pre-contemplation or contemplation stages of behavior change (Prochaska & Velicer, 1997).

Another main finding is that although not statistically significant, primary and secondary outcomes improved more in the IG than the ACG. The IG had greater improvements in measures of fitness (estimated VO_{2max} , METs, resting HR) and cardiovascular risk (total cholesterol, triglyceride, LDL, calculated risk score) compared to ACG. This finding is notable given 35% of the IG could be characterized as low level participators (≤ 1 session and/or ≤ 30 minutes self-report PA/week).

According to ActiGraph measured PA pre and post intervention, both groups increased their PA behavior. The women, knowing they were in a PA behavior study may have been motivated to increase PA during ActiGraph measurement. If the ACG had increased time and/or intensity of PA throughout the study, post-intervention fitness measures should have been comparable to the IG. Although not significant, the IG had greater improvement in VO_{2max} , METs, and resting HR compared to the ACG suggesting the IG engaged in more and/or more intense PA throughout the study.

Implications for Practice

Future PA behavior interventions may address drop-out by use of readiness to change screening and/or inclusion criteria to include only those who are in preparation and action stages of change (Prochaska & Velicer, 1997). Continued enrollment to replace dropout participants once the intervention had begun was not feasible. Interventions delivered in the workplace have appeal, offering employees a convenient, low-cost means to support health behavior change. Excluding participants in the pre-contemplation stage of change would facilitate efficient use of resources and promote a stronger group dynamic. Social norms, social patterns of behavior, social support, and modeling all have influence on PA behavior (McNeill, Kreuter, & Subramanian, 2006b). Non-attendees may have weakened intervention effects through missed

opportunities for participants to connect with others making the same changes in PA behavior or partner to engage in PA together.

The peer-modeling intervention has promise as an effective and feasible method of PA behavior change among inactive working women by using resources already commonplace in organizations: fitness center, occupational health office and staff, and employees already successful with engaging in a healthy level of PA.

A common focus of workplace wellness programs is weight-loss. However, just as weight, BMI, and blood pressure can be measured and counseled on in the occupational health setting, so too can self-report PA behavior, resting HR, and even fitness. Adults with low to moderate cardiovascular risk are appropriate for sub-maximal fitness testing such as walk/run, cycle, or step tests. Because “fitness” is more influential on morbidity and mortality than “fatness”, methods of assessing and boosting fitness are needed (Barry et al., 2014; McAuley et al., 2014). Occupational health may serve as an important venue for addressing the fitness deficit among some working adults.

Limitations to the study include a small sample size, predominately Caucasian participants, and a single workplace setting which limit generalizability to other populations and other work environments. A strength of this study was the randomized design intervention, testing for the first time, a strategy using peer-models to provide vicarious experience to increase PA behavior in the workplace. The findings support the need for a fully powered study.

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Table 1. *Baseline Female Participant Demographics*

Variable	ACG (n = 24)		IG (n = 26)		Statistical Comparison
	M	SD	M	SD	<i>p</i> value
Age (yr.)	43.4	8.8	43.5	12.4	.02 ^a
	N	%	N	%	
Caucasian	22	92	24	92	.26 ^b
Married or partnered	19	79	18	69	.40 ^b
Income < \$75,000/year	6	25	9	35	.09 ^c
Employed Full-time	22	92	24	92	.23 ^c
Work in clinical position	7	29	17	65	.01 ^b

^aIndependent sample t test, ^bPearson Chi-Square, ^cFisher's exact test

Table 2. *Baseline Mean Values for Fitness and Cardiovascular Risk Indicators by Group*

Variable	ACG (n = 24)		IG (n = 26)		<i>t</i> -test
	Mean	SD	Mean	SD	p Value
Self-report \geq moderate level minutes PA	44.6	33.2	63.5	89.7	0.04
Measured \geq moderate level minutes PA (ActiGraph)	96.3*	66.6*	104.4	79.3	0.42
METs	6.7	1.6	6.7	1.9	0.43
Estimated $\text{VO}_{2\text{max}}$ ($\text{mL/kg}^{-1}/\text{min}^{-1}$)	23.6	5.5	23.7	6.81	0.42
Resting HR (beats per minute)	76.6	9.6	77.2	8.9	0.59
BMI (kg/m^2)	31.6	6.9	33.0	6.3	0.32
TC (mg/dL)	187.4	26.1	184.5	30.6	0.36
LDL-C (mg/dL)	112.1	22.9	103.4	29.6	0.12
Triglyceride (mg/dL)	125.6	46.8	112.4	52.3	0.58
HDL-C (mg/dL)	54.6	14.6	58.9	10.4	0.21
Lifetime cardiovascular risk score	5.9	6.21	10.2	12.7	.004

*n = 23

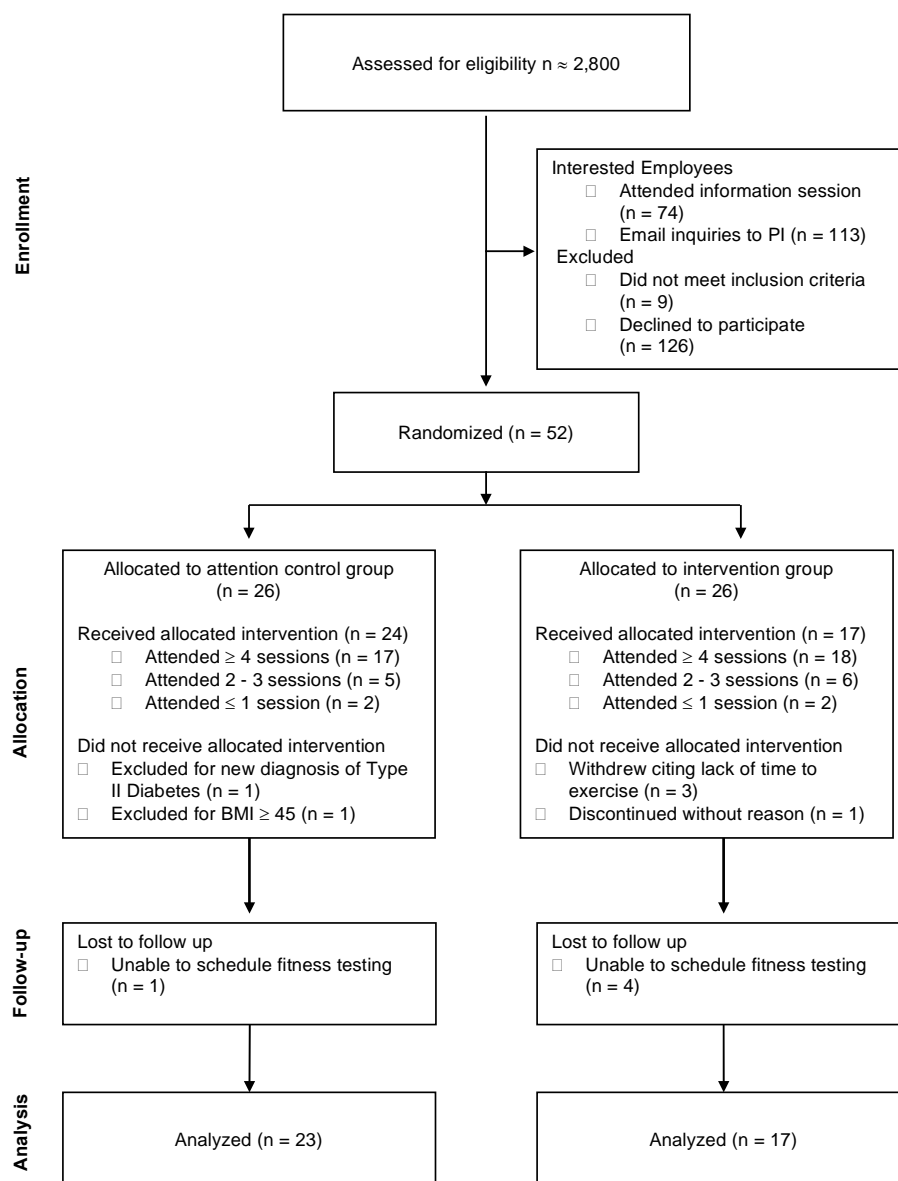


Figure 1. Study flow diagram

CHAPTER IV: Manuscript 3

Vicarious Experience to Affect Physical Activity in Working Women:

Results of a Randomized Control Trial

Abstract

People compare themselves to others for self-evaluation, practical information, and motivation for behavior change. The effect of a “healthy” peer-model on comparison thinking and health behavior has not been found across workplace physical activity (PA) intervention studies. The purpose of this pilot study was to evaluate the effect of a workplace peer-modeling intervention on self-efficacy, motivation, and social comparison for PA. A randomized, two-group, design was used. Inactive females recruited from a Midwestern health system were randomized to either an attention control group (ACG) (n = 26) or an intervention group (IG) (n = 26). The ACG received general health information. The IG met with seven active peer-models, and received an exercise prescription and PA information. Baseline and 12-week measures were: self-efficacy, motivation, and social comparison for PA. Data analysis was conducted using hierarchical linear modeling. Forty-three women (ACG n = 22; IG n = 21) completed pre and post measures. There were no significant group by time interaction effects. Both groups decreased in self-efficacy for PA while motivation remained stable. Both groups increased in comparisons for distancing, similarity identification, and self-enhancement. Although not statistically significant, the IG group increased more in comparisons of abilities, opinions, modeling, and future self, compared to the AC group. Comparison thinking may support PA behavior change by identifying with a model for the behavior and thinking about future self as an active person. Results support testing with a fully powered study.

Background

A mere 21% of U.S. adults meet current recommendations for healthy PA known to prevent disease and promote health (“Facts about Physical Activity | Physical Activity | CDC,” n.d.); 150 minutes of moderate-level aerobic PA and two days of strengthening activities per week (Committee, 2008a). Leading health organizations encourage the use of evidenced-based strategies to improve health behaviors and self-efficacy development is a recommended strategy to increase PA (Artinian et al., 2010). According to social cognitive theory, self-efficacy can be improved through vicarious experience (Bandura, 1998). That is, observing someone else succeed at a given task or behavior, is vicarious experience. Closely related to self-efficacy and vicarious experience is the theory of social comparison; comparing oneself to another for self-evaluation, self-enhancement, and/or self-improvement (Festinger, 1954). Specifically, a self-assessment is made in comparison to another in either an upward (they are better off than me) or downward (they are worse off than me) manner. This then frames the motivation for behavior change to either gain health or avoid illness. Social comparison is also influenced by the perception of similarity. If the comparison person is considered too dissimilar (age, ability, socioeconomic status) then a comparison for self-evaluation and subsequent behavior change is not likely (Festinger, 1954).

To better understand the effects of vicarious experience as an intervention to improve PA, measurement of the concept is needed. Only two measures were found that assessed comparative thinking: the Iowa-Netherlands Comparison Orientation Measure (INCOM) (Gibbons & Buunk, 1999) and the Social Comparison Motives Scale (SCMS) (Tigges, 2009). The INCOM measures general tendency to compare on self-performance (abilities) and self-beliefs (opinions) (Gibbons & Buunk, 1999). The SCMS was developed to measure motives for comparison thinking about pregnancy prevention behavior in adolescents (Tigges, 2009). Items in the SCMS are generic in form and could be applied to various situations in which people might compare themselves to others regarding a behavior change such as PA.

Social comparison has been effective in improving health behaviors such as condom use (Tigges, 2001), smoking cessation (Gerrard, Gibbons, Lane, & Stock, 2005), weight control (Mueller, Pearson, Muller, Frank, & Turner, 2010), and sunscreen use (O’riordan, Geller, Brooks, Zhang, & Miller, 2003). Intervention studies using social comparison to affect PA behavior were not found.

The purpose of this pilot study was to compare the effect of a peer-modeling workplace PA intervention in a group of physically inactive women to an attention control group, on the theoretical variables: self-efficacy, motivation, and social comparison for PA. The effects of this intervention on the primary outcome of cardiorespiratory fitness and secondary outcomes of PA behavior and lifetime cardiovascular risk are described elsewhere (Rowland, Berg, K. E., et al., 2017).

Methods

Design

A randomized, two-group, repeated measures design was used. Measures were collected prior to randomization, at baseline and repeated at 12-weeks post intervention.

Sample and Setting

Self-report physically inactive women (≤ 60 moderate or ≤ 20 vigorous minutes PA/week) working at a Midwestern health system were recruited from mid-December through January using the organization’s intranet home page, weekly newsletter, and employee health office. The study site employs approximately 3,500 people, 80% of which are female. Inclusion criteria were: female, 19 to 65 years of age, employed at least 20 hours/week, and physically inactive by self-report. Exclusion criteria were: high cardiovascular risk (Arena et al., 2014), body mass index (BMI) ≥ 45 kg/m², inability to complete cycle fitness testing, pregnancy or planned pregnancy during the study, night shift worker, or participant in a weight-loss or exercise program.

Sample size was determined using G*Power (Faul et al., 2007) under univariate RM-ANOVA within-between interaction (time*group effect). With $\alpha = 0.1$, two groups over two time points, a sample size of 50 has 80% power to detect an effect size of $f = 0.178$, which is equivalent to a (d) of 0.357. The alpha level used is appropriate for a preliminary study (Hertzog, 2008). The medium effect size was consistent with effect sizes found in workplace PA interventions using maximal oxygen consumption VO_{2max} to measure fitness outcomes (Conn et al., 2009b).

From the 187 women who attended informational sessions and/or emailed the PI about participation, 52 completed informed consent and were randomized to the attention control group (ACG) ($n = 26$) or the intervention group (IG) ($n = 26$). Two participants were removed from the ACG following baseline assessments; one for $BMI \geq 45 \text{ kg/m}^2$ and the other for a new diagnosis of type II diabetes. Despite more in the IG receiving the allocated intervention compared to the ACG (IG $n = 26$; ACG $n = 24$), drop-out and loss to follow-up were higher in the IG. The resulting sample for analysis was ACG $n = 22$ and IG $n = 21$.

Intervention

Preparation. Active female employees from the study site were recruited to serve as active peer-models to provide vicarious experience for living an active lifestyle. Twenty-one women were interviewed about their PA and seven were selected to deliver the intervention. Per self-report, these peer-models engaged in ≥ 150 minutes of moderate level PA/week, for at least the past six months and were diverse in age, ethnicity, occupation, and experiences with PA. Following training on ethical research conduct and orientation to the study, the peer-models were asked to create a 20-minute PowerPoint describing their motivation, barriers, facilitators, self-monitoring, goal setting, and technology used for PA.

The theoretical basis for the intervention was social comparison theory (self-improvement based on comparison to others) (Festinger, 1954) and self-efficacy theory (confidence in one's capabilities for a given behavior) (Bandura, 1998). In this study, peer-

models provided social comparison/vicarious experience to participants by describing themselves and their experience with PA. Participants could then compare themselves to someone similar (i.e. age, occupation, family demands), yet successful with a healthy level of PA. It was hypothesized that peer-models would boost confidence, motivation, and practical knowledge for improving PA, among IG participants.

Intervention group. The IG participants had a one-time, 20-minute private meeting with a nurse practitioner trained in exercise testing and health coaching, to review fitness testing and receive an exercise prescription. An appropriate level of PA intensity was determined for IG participants based on their baseline cycle fitness test: 40 - 60% of $HR_{reserve}$ for low-fit and 60 – 70% of $HR_{reserve}$ for moderately-fit participants. The exercise prescription included: a) prescribed target heart rate (HR) calculated from cycle test results ($HR_{max} - HR_{rest} \times \% \text{ intensity desired} + HR_{rest}$) (Arena et al., 2014), b) teaching on the rating of perceived exertion (RPE) scale (Borg, 1982), c) direction on submitting weekly logs documenting type and minutes of PA, peak HR, and peak RPE during moderate-level PA lasting ≥ 10 minutes, and d) direction to engage in ≥ 150 minutes of moderate-level (RPE 12 to 15) PA/week.

Over the 12-week intervention, the IG group met every other week at the workplace for a 45-minute group lunch and learn presentation. Each of the six sessions included: 10 minutes of principal investigator (PI) presenting the on the health benefits of PA, 20 minutes of peer-model presenting their PA story, and 10-15 minutes of peer-model taking questions from participants. The IG group encountered seven different peer-models; one per session except for the last session. The last session featured two peer models as the extra peer-model was not needed as a substitute during the study.

Attention Control Group. The ACG did not receive results of their fitness test or an exercise prescription until after post-intervention measures were collected. They were asked to maintain their baseline level of PA throughout the study. Over the 12-week intervention, the ACG met every other week for six lunch and learn sessions. The 45-minute health topic

presentations were delivered by four different master's prepared nurses (including PI) with expertise in the topic areas of healthy diet, cancer prevention, stress management, pain management, and sleep.

Procedures. The study was approved by the study site and the University's Institutional Review Board. Following informed consent, baseline measurements were collected and participants were then randomized to either the ACG or the IG. An advanced practice nurse investigator trained in fitness testing completed all assessments and collected questionnaires in a private area of the employee fitness center.

Measures

Table 1 describes the study measures collected at baseline and post-intervention at 12 weeks.

Self-efficacy. Confidence for adopting and maintaining moderate-intensity PA for at least six months was measured using the 12-item Self-Efficacy and Exercise Habits Survey (Sallis, Pinski, Grossman, Patterson, & Nader, 1988) (Appendix D). This questionnaire has two subscales: "making time for exercise" and "sticking to exercise". Higher scores on "making time" indicated greater confidence to dedicate time to PA. Higher scores on "sticking to it" indicated greater confidence to engage in PA despite barriers not to. This tool has test-retest reliability (0.68) and internal consistency (alpha coefficients 0.83 and 0.85) (Sallis et al., 1988). The questionnaire was modified by changing the word "exercise" to "physical activity." At baseline, Cronbach's alpha for "sticking to it" was 0.86 and "making time" was 0.80; at post-intervention "sticking to it" was 0.88 and "making time" was 0.62.

Social comparison. General tendency to compare oneself to others was measured with the Iowa-Netherlands Comparison Orientation Measure (INCOM) (Gibbons & Buunk, 1999) (Appendix E). This 11-item Likert-type questionnaire has two subscales measuring comparisons of "ability" (5 items) and "opinions" (6 items). The tool has high reliability (Cronbach's alpha 0.78 to 0.85) of abilities and opinions respectively (Gibbons & Buunk, 1999). Higher scores

indicate more comparison thinking of “abilities” and “opinions”. Cronbach alphas at both time points were 0.74 for “abilities” and 0.82 and 0.69 for “opinions”.

Reasons for comparison to others was measured using an adapted Social Comparison Motive Scale (SCMS) (Tigges, 2009) (Appendix F). The 19-item Likert-type questionnaire has five subscales to measure motives for comparison: distancing (3 items), similarity identification (3 items), enhancement (4 items), modeling (3 items), and future self (6 items). Higher scores indicate more comparisons for that motive. The questionnaire was tailored to PA behavior with the instructional sentence “Think about comparisons you make with other people when thinking about becoming physically active”. The original tool was reliable (Cronbach’s alpha 0.91) and valid (content validity index 1.0) in adolescents (Tigges, 2009). In this study, all social comparison subscales had acceptable reliability and Cronbach alphas ranged from 0.80 to 0.92.

Motivation. Motivation for PA was measured using three investigator-developed Likert-type questions (Appendix F). The questions were added to the adapted SCMS. Higher scores reflect higher motivation for PA. Cronbach’s alpha at baseline was 0.86 and post intervention was 0.84.

Analysis

Participants were examined on an intent-to-treat basis. Statistical Package for Social Sciences (SPSS) software (v. 24) (*Statistical Package for Social Sciences*, 2016) was used to screen and analyze demographic and outcome variables. Analysis using repeated measures ANOVA was initially planned. However, due to participant drop-out (IG = 9; ACG = 3), hierarchical linear modeling was used to examine group by time interactions for the outcome variables. Statistical significance was determined with a p -value < 0.10 .

Results

At baseline the ACG and IG were similar in age ($M = 43.5 \pm 10.7$ years). Both groups were mostly Caucasian, married/partnered and worked full-time (Table 2). More participants in the IG worked in a clinical position (direct patient care) than in the ACG. At baseline, there were

no significant group differences in self-efficacy, motivation, and social comparison for PA. In general, scores on each of the measures fell around or just above the mid-point for each scale indicating moderate levels of self-efficacy, motivation, and social comparison for PA at baseline (Table 3).

There were no group by time interactions for self-efficacy, motivation, and social comparison for PA (Table 4). Over time, self-efficacy for PA scores fell in both groups while motivation scores remained stable. On the adapted social comparison motives measure (SCMS) both groups increased in comparisons to distance themselves from someone who is inactive (distancing), to find similarities with someone who is active (similarity identification), and to feel better about themselves (self-enhancement). Though not significant, there were notable group differences in four of the seven areas of comparison thinking. Comparisons on ability (how well am I doing), opinions (what should I think or believe), future self (to think about my future) and modeling (be like someone else) all increased in the IG but decreased in the ACG (Table 3).

Discussion

The intervention in this study was designed to provide vicarious experience for living a physically active lifestyle (at least 150 minutes of moderate-level aerobic activity/week) by using active peer-models. Although no significant group differences were found, the IG in this study increased their average scores on all seven of the social comparison scales. In contrast, the ACG's mean scores decreased on four of the seven scales. Two of these scales, abilities and opinions, were related to comparison thinking in general; two scales, modeling and future self, were related to comparison thinking specific to PA. The ACG had less and the IG reported more comparisons on ability (how am I doing) and opinions (what should I think or believe). Perhaps the intervention facilitated some self-evaluation/improvement thought about being more physically active.

There were also directional differences for the subscales modeling (to be like someone else) and future self (to think about my future). The IG group had more and the ACG had less of

these comparisons over time. It may be that in the context of a vicarious experience for a health behavior, comparison thinking may support behavior change by identifying with a trusted model and thinking about the future as an active person. Prior research has identified a relationship between social comparison thought and health behavior. Smokers who had higher levels of social comparison in general had greater success with cessation than smokers who had lower levels of social comparison (Gerrard et al., 2005). Adolescents who had contact with HIV-positive peers had increased motivation to get tested for HIV (Misovich, Fisher, & Fisher, 1997). With respect to PA, higher levels of social comparison measured by the INCOM, correlated with higher levels of self-report PA in a large sample of adolescents ($n = 2,387$) (Luszczynska, Gibbons, Piko, & Tekozel, 2004). This study begins to address what people may attend to, or be motivated by, in a vicarious experience to change a health behavior.

The IG also had nonsignificant increased scores on the social comparison subscale of similarity identification. Social comparison theory suggests that comparisons for self-improvement are influenced by the perception of similarity with the target of comparison. That is, similarity on certain attributes like age, gender, family status, and work, provide a frame of relevance for making comparisons to improve. The increase in similarity identification may be an indication that IG participants were considering their own improvement compared to the behavior of the peer-models; “If they can do it, so can I”. These findings suggest that the social comparison peer-modeling intervention may be an effective strategy for PA behavior change.

Related to social comparison theory, social cognitive theory explains observational learning by seeing someone else succeed with a task or behavior. In this study both groups decreased in self-efficacy while motivation for PA remained stable. Perhaps participants in the IG had a decline in self-efficacy once they started trying to meet the activity goals of the study. In other words, the baseline self-efficacy scores may reflect participant’s self-confidence for being active in general terms and the post-intervention scores may reflect participant’s self-confidence for being active in very specific terms (150 minutes moderate-level activity at

prescribed HR and RPE). The ACG did not receive an exercise prescription or meet with peer-models, yet they had the same pattern of stable motivation and a decrease in self-efficacy as the IG. It may also be that additional time points and/or a different tool to measure self-efficacy for PA is needed to better evaluate this variable over time.

There is meta-analytic support for targeting self-efficacy to improve PA behavior in healthy and obese adults (Ashford, Edmunds, & French, 2010b; Olander et al., 2013). Furthermore, there is evidence recommending specific strategies to affect self-efficacy over others. Those intervention strategies associated with higher self-efficacy and PA behavior are specific instruction on behavior, detailed action planning, and progress praise and reward for making progress. Intervention strategies associated with lower self-efficacy and behavior are set graded tasks (increasing difficulty of target behavior) and relapse prevention. As an intervention strategy, social comparison (drawing attention to a successful model) has been associated with larger effect size estimates for PA and positive effect size estimates for self-efficacy (Williams & French, 2011).

This is the first study known to use a randomized, two-group intervention design to increase PA behavior through vicarious experience using peer-models. Although not significant in this small sample, group differences on some measures of social comparison suggest the intervention has promise for affecting some motives for comparison thinking. More needs to be understood about the relationship between making social comparisons and making health behavior change and whether that relationship varies based on age (adolescent vs. adult), type of health behavior, or stage of change readiness. Further research in this area would help strengthen current general recommendations to use vicarious experience in interventions targeting health behaviors like PA, by providing guidance on who and how to best use the strategy.

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Table 1.
Study Measures, Concepts, and Theoretical Definitions

Measure	Concept/ Sub-concepts	Definition
Adapted Self-Efficacy and Exercise Habits Survey ¹⁶	Self-efficacy for PA <ul style="list-style-type: none"> • Sticking to it • Making time 	Confidence to continue PA despite barriers not to Confidence to dedicate time to PA
Investigator developed questions	Motivation for PA	Motivated by another to be physically active
Iowa-Netherlands Comparison Orientation Measure ⁴	Social Comparison Orientation <ul style="list-style-type: none"> • Abilities • Opinions 	Self-evaluation of performance and/or skills compared to others Self-evaluation of beliefs and views compared to others
Adapted Social Comparison Motives Scale ⁵	Social Comparison Motives	
	• Distancing	To want to be unlike someone
	• Similarity Identification	Recognition of shared attributes with another (age, job, family status)
	• Self enhancement	To feel good about oneself
	• Modeling	To follow the example of another person
	• Future self	To think about oneself in the future
PA = physical activity		

Table 2.
Baseline Female Participant Demographics by Group

Characteristic	Attention Control Group (n = 24)		Intervention Group (n = 26)	
	n	%	n	%
Age (yrs.)				
19-29	1	4	3	8
30-39	8	33	9	35
40-49	8	33	4	15
50-59	7	29	6	23
60-65	0	0	4	15
Marital status				
Married/partnered	19	79	18	69
Number of Children				
0	6	25	6	23
1-2	12	50	13	50
3-4	6	25	7	27
Ethnicity				
White/Caucasian	22	92	24	92
African American	1	4	0	0
Asian	1	4	0	0
Hispanic/Latino	0	0	2	8
Occupation				
Clinical	7	29	17	65
Non-clinical	17	71	9	35
Full-time status	22	92	26	100

Sample includes all participants allocated to either intervention

Table 3.
Mean Values For Self-efficacy, Motivation, and Social Comparison by Group

Measure	Total Possible Range	Attention Control Group				Intervention Group			
		Pre (n = 24)		Post (n = 22)		Pre (n = 26)		Post (n = 21)	
		M	SD	M	SD	M	SD	M	SD
Self-efficacy									
Sticking to it	7 - 35	26.33	5.59	24.45	5.92	27.53	5.36	26.23	5.06
Making time	4 - 20	15.08	3.58	14.68	3.41	16.53	3.26	14.19	3.74
Motivation	3 - 15	9.21	3.34	9.27	2.89	9.77	3.94	9.81	2.96
Social comparison orientation (INCOM)									
Abilities	5 - 25	15.63	3.96	15.09	3.97	15.19	3.83	15.52	3.17
Opinions	6 - 30	19.50	4.61	18.82	3.94	18.31	4.68	19.17	3.14
Motive for social comparison (Adapted SCMS)									
Distancing	4 - 16	12.88	3.35	13.18	3.75	12.77	3.02	14.10	3.14
Similarity	3 - 12	7.58	2.94	7.86	3.22	7.73	2.94	9.05	2.39
Enhancement	4 - 16	10.38	4.20	10.68	4.32	10.54	4.16	11.76	3.83
Modeling	3 - 12	8.46	3.33	8.41	2.77	8.65	2.62	9.95	2.50
Future	6 - 24	18.71	5.40	18.45	5.82	18.58	5.27	20.24	4.19

INCOM = Iowa-Netherlands Comparison Orientation Measure, SCMS = Social Comparison Motives Scale

Table 4.
Group By Time Interaction Effects on Secondary Outcomes Self-Efficacy, Motivation, and Social Comparison

Variable	Beta	SE	df	t	p
Self-efficacy					
Sticking to it	0.046321	0.215008	42.545	0.215	0.830
Making time	-0.18581	0.234164	41.907	-0.794	0.432
Motivation	-0.43031	0.910618	42.257	-0.473	0.639
Social Comparison Orientation (INCOM)					
Abilities	0.418696	0.7322391	43.823	0.572	0.570
Opinions	0.595504	0.849316	42.200	0.701	0.487
Motive for Social Comparison (Adapted SCMS)					
Distancing	0.922858	0.846824	43.122	1.090	0.282
Similarity	0.795868	0.880244	43.897	0.907	0.371
Enhancement	0.527808	0.985289	42.755	0.536	0.595
Modeling	1.28162	0.792533	42.716	1.617	0.113
Future	1.46781	1.38700	42.742	1.058	0.296

INCOM = Iowa-Netherlands Comparison Orientation Measure, SCMS = Social Comparison Motives Scale

CHAPTER V: Manuscript 4

Perceptions of a Peer-Modeling Workplace Physical Activity Intervention for Women

Abstract

A workplace physical activity (PA) study tested a novel use of peers to deliver the intervention. Peer-models provided vicarious experience for living a physically active lifestyle to a group of self-reported inactive women. The purpose of this study was to describe participants' perceptions of the peer-modeling intervention. Nine women from the intervention group ($n = 26$) participated in a 90-minute focus-group. Qualitative description using thematic analysis was used to identify patterned responses from the focus-group transcript. Two themes about the intervention were identified: "wanting more" and "focus on food." Two themes about the peer-models were identified: "real people" and "it's doable." In general, focus-group participants perceived the peer-modeling PA intervention favorably; however, more attention to healthy eating and more time with peer-models was desired.

Background

Work, marriage, and children are common life experiences in adulthood associated with physical inactivity (Bellows-Riecken & Rhodes, 2008; Tudor-Locke, Leonardi, Johnson, & Katzmarzyk, 2011). Working women in the U.S. are an at-risk group for inactivity with less than 26% meeting guidelines for healthy physical activity (PA); 150 minutes of moderate-level or 75 minutes vigorous-level aerobic activity and two days of strengthening activities per week (Blackwell & Clarke, 2016; Committee, 2008b). One strategy to improve health behaviors, including PA, is the use of peers. Across health behavior research, peers have been used to provide education, social support, behavior norms, advocacy, and to increase self-efficacy (Simoni, Franks, Lehavot, & Yard, 2011). Evidence for the effectiveness of peer-based interventions continues to emerge. How peers are defined and how they are used in interventions varies widely and few studies offer a theoretical explanation for the peer-effect (Simoni et al., 2011). Only two randomized workplace PA intervention studies were found to use peers; one used peers to provide PA information and another to organize and/or lead PA activities (Rowland & Yates, 2017). Because these studies used peers as part of multi-component interventions, the effect of peers as the central intervention strategy remains unclear.

In a recent workplace PA study, peers were used to provide a vicarious experience for living a physically active lifestyle to intervention group participants (Rowland et al., 2017). The intervention was based on social cognitive theory (self-efficacy) (Bandura, 1998) and social comparison theory (self-improvement based on comparison to others) (Festinger, 1954). To deliver the intervention, self-reported physically active (≥ 6 months) women were recruited from the study site to share their story of living an active life with the intervention group. Seven women served as active-peer models; each one presented on the barriers, facilitators, motivation and technology used to engage in regular, moderate-level PA. It was hypothesized that active peer-models from the study site would serve as a target of comparison for living an active lifestyle and facilitate PA behavior change among a group of inactive women. Although there

was not a significant intervention effect, there was greater improvement in cardiorespiratory fitness and cardiovascular risk among the intervention group compared to the attention control group (Rowland et al., 2017). A focus-group was held to determine participants' perceptions of the intervention and how it did or did not help with PA behavior change. The purpose of this study was to describe participants' perceptions of a novel, peer-modeling intervention to increase PA behavior among a group of inactive working women. Findings were used to inform on the feasibility and effect of the intervention.

Methods

Design

Following the intervention, all participants from the intervention arm were invited to a one-time, 90-minute focus-group to share their perceptions of the intervention, peer-models, and changing PA behavior. The intervention was used in an experimental, two-group (intervention and attention control), repeated measures (baseline and 12-weeks) study design (Rowland, Berg, Kris E., et al., 2017). The primary outcome of the workplace peer-modeling PA intervention study was cardiorespiratory fitness and the secondary outcomes were PA behavior, lifetime cardiovascular risk, self-efficacy, motivation, and social comparison for PA behavior. The primary and secondary quantitative outcomes were detailed elsewhere (Rowland, Berg, et al., 2017; Rowland, Kupzyk, Cohen, Pullen, & Yates, 2017).

Sample and Setting

Of the twenty-six intervention group participants, nine attended the focus-group. The only inclusion criterion for the focus-group was randomization to the intervention arm of the workplace peer-modeling PA study. There were no exclusion criteria for participation in the focus-group. Inclusion criteria initially used for the intervention study were: female employee between 19 and 65 years of age, worked ≥ 20 hours/week, and self-reported ≤ 60 minutes moderate or ≤ 20 minutes vigorous PA per week. Exclusion criteria initially used for the intervention study were: greater than moderate cardiovascular risk, (Arena et al., 2014), ≥ 45

kg/m² body mass index (BMI), inability to complete cycle fitness testing, pregnancy, night shift worker, participant in a weight management or exercise program, and taking a beta-blocker medication. The study was conducted at a Midwestern health system employing approximately 3,500 people, 80% of whom were female.

Intervention Development

To prepare active-peer models to deliver the intervention, they were oriented to the study, completed Collaborative Institutional Training Initiative (CITI) training, and were asked to create a 20-minute PowerPoint describing and depicting their life as a physically active woman. Each presentation followed the same format: personal demographics (family status, job, hobbies), PA level as a young person, turning point for becoming more active (if applicable), barriers to being active, facilitators to PA (if applicable goal-setting and self-monitoring), motivation to be active, and technology or tools used for PA. The presentations averaged 10 - 15 slides with 15 - 20 images of themselves, their families, PA activities, technology used, and motivating quotes or images. The peer-models agreed to present their story and take questions from intervention group participants in a 45-minute lunch and learn format. A different peer-model presented each session, except for the last session; two peer-models presented. Each session also included 10 - 15 minutes on the health benefits of PA.

Data Collection

A 90-minute audio-recorded focus-group was held in a private conference room at the study site. The PI led the session guided by an a-priori interview guide (Table 1). A PhD student served as assistant moderator by taking notes during the session. To stimulate recall, focus-group participants were provided a handout that featured a picture of each of the seven peer-models with their name, age, and work position indicated.

Procedures

The study was approved by the study site and the university's institutional review board. Informed consent was obtained prior to enrolling participants into the study. Following post-intervention study measures, all intervention group participants were invited to the focus-group to discuss the intervention.

Analysis

Qualitative analysis of the focus-group followed Braun and Clarke's (2006) method of thematic analysis (Braun & Clarke, 2006). The audio recording was transcribed verbatim. Transcripts were reviewed by two investigators multiple times before they conducted line by line review to code significant statements. Codes were then organized according to the interview guide questions (Table 1).

Results

Nine intervention group participants attended the focus-group and were mostly Caucasian, married/partnered and worked full-time; six were employees with sedentary work duties. Those attending were older ($M\text{ yr} = 47.4 \pm 10.0$) than the entire intervention group ($M\text{ yr} = 43.5 \pm 12.4$). The focus-group participants were also more engaged with the intervention, submitting more PA logs (focus-group $M = 10.0 \pm 1.7$; intervention group $M = 8.3 \pm 1.5$) and attending more sessions (focus-group $M = 5.0 \pm 0.8$; intervention group $M = 4.2 \pm 1.5$) than the intervention group. Four themes emerged from the qualitative analysis: a) wanting more, b) focus on food, c) real people, and d) it's doable.

Intervention Format

Wanting more. In general, focus-group participants indicated they "liked" and were "motivated" by most aspects of the study. Regarding the intervention format, two themes emerged across question topics. The first theme was "wanting more". Participants expressed an interest and enjoyment in both the method of intervention delivery (lunch and learn sessions, informational content, peer-model presentations, activity logs) and the peer-models themselves.

However, they desired more meetings, continued accountability with activity logs, additional health information, more time with peer-models, and more opportunities to support each other. Remarks that illustrate “wanting more” include: “I was sad that it ended at the 12 weeks.... I just felt like a lot of us were getting comfortable with being active”, and “I would have liked to be accountable for longer periods doing the logs and stuff, even if we didn’t have the every other week thing”, and finally “I kinda feel like, where do I go from here?”

Participants in the focus-group also wanted more support for measuring heart rate beyond the manual method they were taught when they received their exercise prescription. Most focus-group participants did not have an activity tracker and some had difficulty taking their own pulse. Some experimented with other methods of tracking heart rate (pulse oximetry, phone app) and others bought themselves an activity tracker. One participant remarked:

At first I didn’t have a monitor at all, I just used the flash on the back of my phone, like we heard in the class, that helped. Then I got that app, and that helped. But then I was like this is kind of annoying cause I’d have to turn my phone on, get the app up, and if my phone died [giggling], it was disaster. Then I ended up getting a Fitbit®, and now I’m obsessed with it.

The theme “wanting more” was evident in the focus-group discussions about support for making PA behavior change. Peer-models were identified as a potential source of “wellness coaching”, a “mentor”, someone to meet with, exercise with, and walk at lunch with. Two fellow participants did exercise together and did meet with a peer-model on their own, outside the intervention, to learn about strength exercises. Several suggested assigning participants to a “buddy” to be more accountable and supported for PA.

Focus on food. The second major theme from the focus-group session was “focus on food”. In this PA study, participants were neither encouraged or discouraged from making dietary improvements. Nutritional content during the intervention was limited to brief comments made by some of the peer-models as context for their healthy lifestyles. Though diet was not a

focus of this study within the focus-group, the topic of discussion repeatedly turned to food and the challenges of maintaining a healthy diet. Participants were observed to “compare notes,” exchanging information, opinions, and experiences on eating and preparing healthy food as individuals and families. Much discussion centered on being “scared” and “intimidated” by healthy food they did not know how to prepare foods like couscous, quinoa, and vegetables. Participants in the intervention group were not directed to change eating behavior however, many focus-group participants reported doing so by monitoring or limiting calories and/or carbohydrates, substituting fruit for chips, cooking more at home, and subscribing to a mail-order fresh food service.

Participants often paired the topics of diet and exercise when commenting on the challenges of healthy behaviors: “it’s still the struggle of just getting it all together, that I can get in that groove and feel like I’m making progress on the exercise and the eating part of it.” Much discussion focused on the need for more nutritional information during the study. For example:

I was hoping for more on food choices, like fast, healthy choice meals. I mean there were some people who talked about food and how they coped with, like, their husband and them not eating similar meals. It would have been nice to know some, like quick recipes.

Another remarked:

It would be nice if that [the intervention] actually had something like that, the wellness coach or group like this, where you had the physical but then you also had the diet and nutrition part of it with it, because then, you get the best of both worlds.

Peer-Models

Real People. In general focus-group participants “really, really liked” the peer-models and the “good stories” that they shared. They “liked that they weren’t professionals” and were “just average people”. Participants remarked “it was a great combination of people at different life stages, dealing with different things” and “it was really good mix, their age, what they do for

work, something about their personal life, and then their journey” and “they all had a different story, something to connect with.” However, not every peer-model appealed to every focus-group participant. Some found one peer-model to be “energizing” and “motivating” while others found the same peer-model “intimidating in her energy level and the fitness level that she’s at.”

Many comments focused on the realness of the peer model through seeing them and the images they used to tell their stories. One participant said:

I think the PowerPoint, everything was really good, being able to see it. You know their busy lifestyles, what works out for them, I believe [peer model] showed us the video of her dancing with her daughter, and I thought that was really nice.

Another participant stated:

I really, I really liked the speakers. You know I was able to get a lot out of just seeing their life, their own success story, and just knowing that are just busy, busy people and even busier than me and they are able to do it. And then, I should be able to do it.

One participant remarked on seeing a peer-model’s before and after pictures using resistance bands, “the pictures were like wow, you know, just using resistance bands. And she had those [resistance bands] to pass around which I thought was really nice also.” Another participant commented:

They were real people, and it’s not like they were walking around with this obsessive kind of approach to it you know. It was just, regular, average daily changes in things.

They weren’t going to the gym five days a week for two hours per day, or so fit now, that they looked like that’s all they did.

The focus-group participants found the peer-models to be “real” through hearing about their struggles and turning points in their lives. For example, one participant remarked “I appreciated how honest they were, like struggling with depression, and then you know someone else talked about their families and then their other issues, their husband, and their kids, and so I thought that was real helpful.” Another participant remarked “their struggles and hang-ups are the same as

what my struggle is kids, work, time, energy, whichever.” The experiences of peer-models were perceived as real as one participant said:

That’s the thing of what was nice about them being, you know, the people that are here [at the workplace] and the fact that they’re not someone who has been on the Biggest Loser or one of those things where you know, it wasn’t reality and it wasn’t that they had you know, three months solitary, where that is all they did.

One of the peer-models was noted to be nervous giving her presentation and a focus-group participant commented “that [her nervousness] just makes it more real, I mean they are, us.”

It’s doable. Participants in the focus-group accepted the peer-models as models for living an active lifestyle. One participant said, “it can be done, ... a lot of times what keeps you from working out is you think, I just can’t work it in, I can’t put the time in...and they [peer-models] modeled that you can.” Not all strategies used by the peer-models appealed to every participant. However, even if focus-group participants were not “into running” or “Zumba” they were accepting of some of the strategies used by the peer-models to be active as “doable.” One participant remarked:

I think one of the greater things that I feel I walked away with was that it doesn’t have to be you know, 30 minutes at a gym, doing this or that. It can be, you know, many different things, it’s just that movement out of the chair, off the couch. You know, I think that’s what I got out of it, that it doesn’t have to be you know, an hour of Zumba five days a week.

Some the focus-group participants described the changes they made based on strategies used by the peer-models such as pacing while waiting for the elevator, standing or walking while watching the news, and taking the stairs. One participant described:

You learn a little bit of something from everyone and it pushes you and [peer model] really got me going just because of her energy. And it’s like ok, yeah, if I’m making popcorn I

can do the exercise while I'm waiting for it. Simple things like that you don't think about or like when you are watching a show you can do sit-ups. I mean you can do that.

Other support for the theme “it's doable” was found in the focus-group participants' desire to have more details about peer models' strategies. A “tips and hints” handout was requested with information about the exact web address and/or name of the application the peer-models were using with PA. Discussion time and peer-model “shadowing” were also suggested to get more detailed information about healthy PA strategies the peer-models were using.

Discussion

In general, perceptions of the peer-modeling intervention and the peer-models themselves suggests the intervention format was acceptable to the focus-group participants. While the use of peers in health behavior interventions is not new, few studies report on participants' perceptions of peers or the theory supporting use of peers in the intervention (Rowland & Yates, 2017; Simoni et al., 2011). This peer-modeling intervention introduced vicarious experience, a less understood strategy for increasing PA behavior. It is uncommon in health behavior research or clinical practice to facilitate behavior change by directing attention to someone else successful with a health behavior. Therefore, it was important to find out what the intervention group participants thought of this strategy. While not all focus-group participants found all peer-models appealing, the focus-group participants were able to articulate what they did or did not like about the peer-models. The theme “wanting more” indicates an opportunity to expand the intervention by increasing time and interaction with the peer-models. The focus-group participants suggested more time for discussion and opportunity to “work out” or “grocery shop” with the peer-models. These comments affirm that the intervention provided a positive vicarious experience for living an active lifestyle.

An interesting finding relating to the intervention format is the theme “focus on food”. During intervention sessions and across focus-group interview questions, participants migrated toward the topic of healthy eating with peer-models and/or with each other. There may be several

explanations for this. Perhaps food is simply more interesting to talk about than PA. There may be a natural tendency to address diet and PA behavior together because they are often paired together in recommendations to be healthy. It may also be that peer-models were regarded as experts in health behavior; seeking “endorsements” of products or methods of food preparation were ways in which participants were learning vicariously through the peer-models. For participants, incorporating more information and support to improve their diet would have expanded the intervention to deliver “the best of both worlds.”

In addition to the comments about the intervention format, the themes identified in this study align with the theoretical variables in the intervention study. The two themes, “real people” and “it’s doable” address one concern for this intervention study regarding comparison thinking; would intervention group participants identify with the peer-models? Social cognitive theory and social comparison theory explain that similarity identification (recognition of shared attributes) is needed for the information gained from a model to be relevant enough to support behavior change (Bandura, 1998; Festinger, 1954). In this study, peer-models and their PA experiences (running 5K and half marathons, kick boxing, Zumba classes) could have been regarded by participants as too dissimilar, even discouraging. Comments by focus-group participants suggest that even though they may have not had interest in PA activities like running half-marathons, there was valuable information and “motivation” to be gained from the peer-models.

Within the theme of “wanting more,” focus-group participants described the peer-models and their experiences as “motivating” and feeling “really motivated to do more” even though they were not asked specifically about motivation. Focus-group participants also described situations where they lacked confidence (self-efficacy) for PA; they were “scared” or “intimidated” by certain activities or “healthy” foods they had never tried or prepared before. By “wanting more” from the peer-models, it may be the intervention was working to alleviate apprehension to engage in certain activities or try healthy foods because of lack of experience with it. There were also statements of social comparison, “I liked the fact that [peer model] and I did the same job” and “I

just saw some similarities in my story as far as clothes not fitting, and using it is as a motivator”. Many of these similarity statements contributed to the theme of “it’s doable”.

There are notable limitations to the findings of this qualitative inquiry. First, the focus-group participants were a sub-sample of the intervention participants who responded to an invitation to discuss the intervention in a focus-group format. Therefore, not all intervention participant views were reflected in this thematic analysis. The focus-group participants were slightly older and more engaged (more PA logs submitted; more sessions attended) with the intervention than those intervention participants who did not participate in the focus-group. In adolescents and young adults, prior social comparison and health behavior research does identify a relationship between comparison thinking and health behaviors like condom use to avoid teenage pregnancy, dietary choices, and PA. (Luszczynska et al., 2004; Tigges, 2001). Research on the relationship between comparison thinking, stage of change (transtheoretical model), and a health behavior outcome has not been found (Rowland & Yates, 2017). For example, it is unclear what effect if any, a peer-model/vicarious experience intervention for health behavior change has on someone who is in a lower stage of change readiness (pre-contemplation). Since the intervention group participants with low-level participation in the intervention did not attend the focus-group, their perception of the peer-modeling intervention was not represented.

Another limitation is the biases introduced by having the principal investigator lead the focus-group. Knowing the principal investigator as an advanced practice nurse working at the study site and that the study was a dissertation project may have influenced participants to either be overly complimentary or less critical than if an unknown person led the focus-group.

Despite the limitations of this qualitative inquiry, the themes identified were positive and begin to reveal what participants may perceive during a peer-modeling intervention to improve PA behavior.

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Table 1.
Focus Group Interview Guide

1.	What was your impression of the group meetings in this study?
2.	What did you think about the active peer-models in this study?
3.	As you think about becoming or staying physically active, what did you observe or come to know from the peer-models that was helpful?
4.	What are the most important things you want to know about or from someone like you, who is physically active.....what do you want to know about people?
5.	How did the other study activities (not the peer-models) affect your physical activity behavior?
6.	What else is important for us to know about this study, physical activity, and peer-models?

CHAPTER VI: DISCUSSION

Summary

The research presented in this dissertation adds to the literature on workplace PA interventions. Specifically, this study provides evidence for continued research on the use of vicarious experience to improve cardiovascular health in working women by targeting PA behavior. The intervention tested in this study was based on a novel combination of social cognitive theory (self-efficacy enhancement through vicarious experience) (Bandura, 1998) and social comparison theory (self-improvement through comparison to someone successful) (Festinger, 1954) with promising effects of the intervention demonstrated for improving cardiorespiratory fitness, cardiovascular risk, and social comparison outcomes.

Chapter II provided a systematic review of the literature on randomized workplace PA interventions targeting PA behavior and/or cardiorespiratory fitness. In this review, intervention strategies were characterized as technology-delivered, person-delivered, or a combination of both strategies (tech and touch). Each strategy type was found to be effective in increasing PA behavior and/or fitness; no one strategy emerged as superior to the others. This is notable given the increase in personal technology used to support healthy PA behavior. Only three person-delivered studies were found with use of trained peers as part of a multi-component intervention; two of the three had significant intervention effects. The role of peers in these studies was to recruit and lead participants in both structured and/or impromptu PA and provide social support. Social cognitive theory was indicated as a supporting theory in all three studies using trained peers. Because the trained peers were part of a multi-component intervention and none of the studies measured cognitive variables, that might explain the “peer-effect”. That is, it was unclear what role the peers were playing in PA behavior change. Likewise, intervention descriptions did not detail peer-participant interactions in terms of number of contacts, and time spent interacting.

Although studies in the review did not provide much guidance on how to design an intervention with peer-models as the central intervention component, there was support for a time

frame and manner of assessment in which a PA workplace intervention might be able to detect change. Many studies with effective interventions, regardless of strategy used (tech, touch, or both), had interventions lasting between 10 and 16 weeks, and used an objective fitness measure (VO_{2max}). While the literature search on workplace PA studies was narrow in scope (randomized trials measuring PA behavior and/or fitness), the findings did provide a foundation upon which an intervention using a less known strategy to increase PA, vicarious experience, might be designed.

Chapter III described the workplace PA peer-modeling intervention, feasibility findings, and intervention effect on the primary outcome of cardiorespiratory fitness and secondary outcome of PA behavior and cardiovascular risk. The intervention was feasible to implement as evidenced by recruiting and enrolling the minimum number of eligible subjects ($n = 52$) during a set enrollment period of six weeks. There was higher drop-out in the IG group compared to the ACG. This was thought to be related to lower levels of readiness for PA behavior change among IG participants.

Both the IG and ACG had significant improvements in PA behavior as measured by ActiGraph at baseline and post-intervention. While not statistically significant, the IG did have greater improvements in the primary outcome of cardiorespiratory fitness (estimated VO_{2max} , METs and resting HR) and secondary outcomes of cardiovascular risk (total cholesterol, triglyceride, LDL and Lifetime cardiovascular risk score), compared to the ACG. This is notable given the greater participant drop-out in the IG ($n = 9$) compared to the ACG ($n = 1$). The non-significant group differences in cardiorespiratory fitness and cardiovascular risk suggest the IG did engage in more and/or more intense PA than the ACG. Together the findings on feasibility and non-significant group differences suggest the peer-model intervention has promise as an intervention strategy to increase PA in working women.

The sample size and lack of diversity in this sample are limitations of this study. However, this study adds to the few studies conducted in the United States. Most randomized workplace PA studies found in the literature review were conducted in a Scandinavian country,

Australia, or Canada (Rowland et al., 2017). With most Americans falling short of a healthy level of PA, PA behavior change strategies tested within the American culture are needed. Another strength of this study is the randomized design testing vicarious experience, a less known strategy for PA behavior change.

Chapter IV presented the peer-modeling workplace PA intervention effects on the theoretical variables supporting the intervention: motivation, self-efficacy and social comparison for PA. Although there were no significant intervention effects, both groups had less self-efficacy with stable motivation for PA over time. There were also non-significant group differences in the four of the seven scales measuring social comparison. The IG had more and the ACG had less comparisons on abilities, opinions, modeling and future self. Drawing attention to a successful model has been associated with larger effect size estimates for PA and positive, but non-significant, effect size estimates for self-efficacy (Williams & French, 2011). This study begins to address what cognitive processes may be active during a comparison/vicarious experience for PA behavior change. This study also tested a social comparison measure (SCMS) developed in adolescents for pregnancy avoidance behavior (Tigges, 2009), in a new population with a new health behavior. Few studies have measured social comparison in relation to a health behavior, and no studies have been found to measure social comparison motives in a population other than adolescents for pregnancy avoidance (Rowland et al., 2017).

Chapter V described IG participants' perceptions of the intervention and the peer-models obtained with a post-intervention focus-group. Using thematic analysis (Braun & Clarke, 2006) two themes about the intervention ("wanting more" and "focus on food") and two themes about the peer-models ("real people" and "it's doable") were identified. Collectively the themes suggest the focus-group participants found the intervention format and the peer-models helpful with PA behavior change. However, nutritional content was desired to support the dietary improvements that focus-group participants wanted to make along with PA behavior changes. The findings of the focus-group are important because they provide support from participants

themselves, on the value of the intervention beyond the quantitative outcomes. A limitation of the focus-group inquiry is that focus-group attendees had high level engagement with the intervention (PA log submission and peer-model session attendance); the views of participants with low-level intervention engagement were not represented.

Practice and Research Implications

This study has implications healthcare providers and researchers with interest in improving health through PA behavior. Using active-peers to increase PA behavior among inactive employees has promise as a feasible strategy because it uses resources already found in some organizations: fitness center, occupational health office, and employees already successful with engaging in a healthy level of PA. Researchers conducting randomized design studies to increase PA behavior and/or fitness in the workplace, may want to consider stage-of-change screening to exclude those in the pre-contemplation stage of behavior change (Prochaska & Velicer, 1997). While there was considerable interest among employees in this PA study, drop-outs in the IG after the first session may have been due to a dislike of the intervention strategy, or shortage of readiness to change PA behavior. Excluding pre-contemplators may help to minimize drop-outs due to low readiness for PA behavior change.

Most workplace health behavior interventions focus on weight loss, however, there may be value in shifting focus to fitness instead of weight-loss. In this study, both the ACG and IG had a significant increase in PA behavior over time with little change in BMI. Although not significant, there were more favorable changes in fitness and measures of cardiovascular risk in the IG compared to the ACG, with a stable BMI in both groups. This is not to say that weight and diet are not important to participants, and in fact, may be more motivating than achieving a higher-level fitness. The focus-group findings did identify weight-loss and healthy eating as a priority in this PA intervention study.

Using active peer-models may be an effective means for increasing PA among inactive fellow employees. However, directing attention to someone successful with a health behavior to

support behavior change like PA, may not be suitable for everyone. It may be that this strategy works best for those who are contemplating or planning change or for those with a tendency for comparative thinking. The effectiveness of this strategy may also depend on the connection made with the active peer. According to social cognitive and social comparison theory, individuals must identify with another before they would consider the methods used by the active peer as something that might work for them too. In this study, focus-group participants did identify the peer-models as “real people;” and similarities they noted were: age, job position, and life experiences like divorce and lifelong struggles with weight. Those assisting others to become more active may want to consider similarities before directing attention to an active-peer. For example, if a top executive in a company has been a lifelong athlete, without any struggles with PA or health, they may not be the best active-peer model for the environmental service worker who is now pre-diabetic. It may be counterproductive and a detriment to someone’s self-esteem to refer to a “miss-matched” active peer.

In this study, self-efficacy was measured as a theory-based (social cognitive and social comparison theories) variable supporting the intervention. Although non-significant, both groups had a decline in self-efficacy with stable motivation for PA over time. This may reflect an adjustment in confidence for behavior change after becoming active with making change. Perhaps additional self-efficacy measurement time points are needed to account for changes in self-efficacy that occur naturally when the specifics of behavior change become real.

Another concern related to measurement is “spot-checking” PA behavior with an activity monitor. In this study, PA behavior in both groups was assessed using an ActiGraph worn daily for one week at baseline and post-intervention. A Hawthorne effect may explain the increase in PA behavior in both groups (McCambridge, Witton, & Elbourne, 2014). Knowing your PA is being monitored may prompt you to be more active. Objectively measuring physiologic indicators of PA behavior (resting HR, VO_{2max} , blood pressure, cholesterol, glucose) may provide a more accurate indication of behavior change and the associated health benefits.

References Chapter I and VI

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APPENDIX A



NEBRASKA'S HEALTH SCIENCE CENTER

Office of Regulatory Affairs (ORA)
Institutional Review Board (IRB)

December 4, 2015

Sheri Rowland, APRN-NP, MSN
College of Nursing
UNMC - 5330

IRB # 597-15-EP

TITLE OF PROPOSAL: Peer Intervention To Increase Physical Activity Among Working Women

DATE OF EXPEDITED REVIEW: 09/11/2015

DATE OF FINAL APPROVAL AND RELEASE: 12/04/2015 **VALID UNTIL:** 09/11/2016

CLASSIFICATION OF RISK: Minimal

EXPEDITED CATEGORY OF REVIEW: 45 CFR 46.110; 21 CFR 56.110, Category 2, 4, 7

The IRB has completed its review of the above-titled protocol. The IRB has determined you are in compliance with HHS Regulations (45 CFR 46), applicable FDA Regulations (21 CFR 50, 56) and the Organization's HRPP policies. Furthermore, the IRB is satisfied you have provided adequate safeguards for protecting the rights and welfare of the subjects to be involved in this study. This letter constitutes official notification of final approval and release of your project by the IRB. You are authorized to implement this study as of the above date of final approval.

Please be advised that only the IRB approved and stamped consent form can be used to make copies to enroll subjects. Also, at the time of consent all subjects must be given a copy of *The Rights of Research Subjects* and "What Do I Need to Know" forms.

The IRB wishes to remind you that the PI is ultimately responsible for ensuring that this research is conducted in full compliance with the protocol, applicable Federal Regulations, and Organizational policies.

Finally, under the provisions of this institution's Federal Wide Assurance (FWA00002939), the PI is directly responsible for submitting to the IRB any proposed change in the research or the consent form. In addition, any adverse events, unanticipated problems involving risk to the subject or others, noncompliance, and complaints must be promptly reported to the IRB in accordance with HRPP policies.

This project is subject to periodic review and surveillance by the IRB and, as part of the Board's surveillance, the IRB may request periodic progress reports. For projects which continue beyond one year, it is the responsibility of the PI to initiate a request to the IRB for continuing review and update of the research project.

On behalf of the IRB,

Signed on: 2015-12-04 15:27:00.000

Sue Logsdon, MS, CIP
IRB/IBC/ESCRO Administrator III
Office of Regulatory Affairs

APPENDIX B



We know children.

March 26, 2015

Initial Review Group
National Institute of Nursing Research
National Institute of Health

Dear Sheri Rowland,

The Children's Hospital & Medical Center in Omaha, Nebraska, is in full support of your Inspiration Study and upcoming grant proposal for the Ruth L. Kirschstein National Research Service Award, Pre-doctoral Fellowship. Children's Hospital & Medical Center is recognized as a 2013-14 Best Children's Hospital by U.S. News & World Report in cardiology and heart surgery, gastroenterology and GI surgery, orthopedics, and pulmonology. Children's hospital is a respected employer in the metro area, and Health & Wellness is an important component in overall job satisfaction and, more importantly, a healthy lifestyle.

Your study using a peer-modeling intervention to increase physical activity in working women supports our mission for employee wellness. Employee wellness can provide long-term benefits to both the workers and the organization. Findings from your research may serve as the basis for employee wellness programming and services in the future.

As VP of Human Resources, I understand that our main campus will be the site for your proposed study including the recruitment of study participants using the organization's intranet, weekly newsletter, and conference room (for use of in-person informational sessions on study participation). The study measures to be completed in the Employee Health Office are to include biometric testing, fitness testing, blood draw and questionnaires. You will also have access to any technology needed to support the conference rooms, in order to deliver your intervention during group sessions. The pathology department will perform lipid analysis and any other tests that may be needed/required. If there are other ways in which the hospital can be useful, please do not hesitate to let us know.

We are enthusiastic about your project and look forward to working with you!

Sincerely,

A handwritten signature in black ink that reads 'Terry Solem'.

Terry Solem
Vice President Human Resources
Children's Hospital & Medical Center
8200 Dodge Street
Omaha, NE 68114-4113

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ChildrensOmaha.org

APPENDIX C

Baseline Demographic Questionnaire

1. On average I am physically active at a **moderate** level _____ minutes per week.
 Examples of **moderate** physical activity are
 - walking briskly
 - water aerobics
 - bicycling slower than 10 miles per hour
 - tennis (doubles)
 - ballroom dancing
 - general gardening

2. On average I am physically active at a **vigorous** level _____ minutes per week.
 Examples of **vigorous** physical activity are
 - race walking, jogging or running
 - Swimming laps
 - Tennis (singles)
 - Aerobic dancing
 - Bicycling 10 miles per hour or faster
 - Jumping rope
 - Heavy gardening (continuous digging or hoeing)
 - Hiking uphill or with a heavy backpack

3. Do you have access to an exercise facility not including the Children's fitness center?

Yes No

4. What year were you born? _____

5. What is your current married status? Circle one
 - Married
 - Widowed
 - Divorced/separated
 - Partnered, but not married
 - Never married

6. How many children do you have? _____
7. How many people live with you? _____
8. How many hours per week do you work? _____
9. What is your occupation? _____
10. What department do you work in? _____
11. Do you deal with patients directly? Circle one yes no
12. What is your racial background? Please answer each category

White	yes	no
Black or African American	yes	no
Asian	yes	no
Native Hawaiian or other Pacific Islander	yes	no
American Indian or Alaska Native	yes	no
Other race (please specify) _____		

13. Which category below best describes your yearly family income? Circle one
 - Below \$50,000
 - \$50,000 to \$75,000
 - \$75,000 to \$100,000
 - Over \$100

APPENDIX D

Physical Activity Self-Efficacy

Below is a list of things people might do while trying to increase or continue regular physical activity such as running, swimming, brisk walking, bicycle riding or fitness classes. Whether you exercise or not, please rate how confident you are that you could be physically active regularly for at least six months. Circle one number for each question.

How confident are you that you can	I know I cannot		Maybe I can		I know I can	Does not apply
1. Get up early, even on weekends, to exercise	1	2	3	4	5	6
2. Stick to your exercise program after a long tiring day at work.	1	2	3	4	5	6
3. Exercise even though you are feeling depressed.	1	2	3	4	5	6
4. Set aside time for a physical activity program; that is, walking, jogging, swimming, biking, or other continuous activities for at least 30 minutes at least 5 days per week.	1	2	3	4	5	6
5. Continue to exercise with others even though they seem too fast or too slow for you.	1	2	3	4	5	6
6. Stick to your exercise program when undergoing a stressful life change (e.g., divorce, death in the family, moving).	1	2	3	4	5	6
7. Attend a party only after exercising.	1	2	3	4	5	6
8. Stick to your exercise program when you have household chores to attend to.	1	2	3	4	5	6
9. Stick to your exercise program when you have excessive demands at work.	1	2	3	4	5	6
10. Stick to your exercise program when social obligations are very time consuming.	1	2	3	4	5	6
11. Read or study less in order to exercise more.	1	2	3	4	5	6

Adapted from Sallis (1988)

APPENDIX E

Social Comparison Orientation

Most people compare themselves with others from time to time. For example, they may compare the way they feel, their opinions, their abilities, and/or their situation with those of other people. There is nothing particularly good or bad about making comparisons, and some people may do it more than others. We would like to find out how often you compare yourself with other people. Please answer how much you agree with each statement below by placing an X in the appropriate column.

	Disagree Strongly	Disagree	Neither agree Or disagree	Agree	Agree Strongly
1. I often compare myself with others with respect to what I have accomplished in life.					
2. If I want to learn more about something, I try to find out what others think about it.					
3. I always pay a lot of attention to how I do things compared with how others do things.					
4. I often compare how my loved ones (significant other, family, friends) are doing with how others are doing.					
5. I always like to know what others in a similar situation would do.					
6. I am not the type of person who compares often with others.					
7. If I want to find out how well I have done something, I compare what I have done with how others have done.					
8. I often try to find out what others think who face similar problems I face.					
9. I often like to talk with others about mutual opinions and experiences.					
10. I never consider my situation in life relative to that of other people.					
11. I often compare how I am doing socially (social skills, popularity) with other people.					

Gibbons & Buunk (1999)

APPENDIX F

Social Comparison Behavior Scale

People sometimes compare themselves to others. Below is a list of reasons why someone might compare himself or herself to someone else. Think about comparisons you make with other people about your physical activity. Please answer each question based on how often you compare yourself to others when you think about being physically active.

I compare myself to others.....	Very Often					Never				
1. To try to be physically active like someone I admire.	1	2	3	4	5					
2. To learn what to do to improve my physical activity.	1	2	3	4	5					
3. To make sure I am not as inactive as they are.	1	2	3	4	5					
4. To show me how to avoid being inactive.	1	2	3	4	5					
5. To give me a goal for physical activity.	1	2	3	4	5					
6. To let me know that I can trust someone else because we are similar in our activity levels.	1	2	3	4	5					
7. To assure myself that I am different from someone who has problems because they are inactive.	1	2	3	4	5					
8. To think about my future as a physically active person.	1	2	3	4	5					
9. To see my strengths and weaknesses to becoming a physically active person.	1	2	3	4	5					
10. To tell myself that I have a lot in common with someone else who is physically active.	1	2	3	4	5					
11. To let me know that we are similar in our physical activity.	1	2	3	4	5					

APPENDIX F

I compare myself to others.....	Very Often					Never
12. To see how to avoid physical inactivity.	1	2	3	4	5	
13. To find out how to be more like someone who is physically active.	1	2	3	4	5	
14. To feel good about myself for being an active person.	1	2	3	4	5	
15. To assure myself that I am different from someone who is less active than me.	1	2	3	4	5	
16. To help me think about what I want from being physically active.	1	2	3	4	5	
17. To make myself feel better about my physical activity level.	1	2	3	4	5	
18. To have someone be an active role model for me.	1	2	3	4	5	
19. To help me decide how active I want to be.	1	2	3	4	5	
20. To motivate me to be physically active.	1	2	3	4	5	
21. To learn how to be physically active.	1	2	3	4	5	
22. To get me excited about physical activity.	1	2	3	4	5	
23. To find out how to be less like someone who is inactive.	1	2	3	4	5	
24. To prevent myself from being inactive.	1	2	3	4	5	